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Manual for the Interim Certification of Laboratories Involved in Analyzing Public Drinking Water Supplies - Criteria and Procedures

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Criteria and Procedures

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16. ABSTRACT

Section 1401(1) of the Safe Drinking Water Act (SDWA), Public Law 93-523, defines "primary drinking water regulations" to include "quality control and testing procedures" to ensure compliance with maximum contaminant levels. Pursuant to the Act, the National Interim Primary Drinking Water Regulations (NIPDWR), 40 CFR 141 and 142 require that for compliance purposes, "samples" will be considered only if they have been analyzed by a laboratory approved by the State except that measurement for turbidity and free chlorine residual may be performed by any person acceptable to the State, and the States must establish and maintain a program for certification of laboratories conducting measurements of drinking water contaminants. This manual describes evaluation procedures and minimum technical requirements recommended for certifying laboratories analyzing public drinking water supplies. In addition to identifying requirements that are critical to the generation of valid data, optional certification requirements have been included as guidance.

In formulating an implementation strategy, EPA fully recognizes that there are many excellent State laboratory certification programs in operation. EPA is also aware that the capabilities of State and local laboratories vary greatly, and that a phased implementation program may be necessary to permit moving toward our goal without creating artificial impediments to the attainment of State primacy. This manual describes how EPA will carry out a program for interim approval and certification of its 10 Regional laboratories and principal State laboratories. States without certification programs are encouraged to use this program as a model; States with equivalent or better certification programs are encouraged to continue and improve. EPA welcomes any comments or suggestions that will improve this manual.

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THE ADMINISTRATOR

To the Reader:

Section 1401(1) of the Safe Drinking Water Act, Public Law 93-523 defines "primary drinking water regulations" to include "quality control and testing procedures" to ensure compliance with maximum contaminant levels. Pursuant to the Act, the National Interim Primary Drinking Water Regulations, 40 CFR 141 and 142 require that for compliance purposes "samples" will be considered only if they have been analyzed by a laboratory approved by the State except that measurements of turbidity and free chlorine residual may be performed by any person acceptable to the State, and the States must maintain a program for certification of laboratories conducting measurements of drinking water contaminants. This Interim Certification Manual is intended to effectuate implementation of those requirements.

This manual describes the Environmental Protection Agency (EPA) interim water supply laboratory certification program and the technical criteria which are considered essential to generate valid data. The technical criteria should be considered as guides for the on-site evaluation; only the methods and procedures in the Interim Primary Drinking Water Regulations or otherwise approved by EPA should be considered as mandatory for Interim Certification of a laboratory. Once the Interim Certification program has been thoroughly evaluated and subjected to public comment, regulations covering certification may be developed along with the Revised Primary Drinking Water Regulations.

While the manual is intended for EPA use in approving and certifying laboratories in a uniform and impartial manner, EPA fully recognizes that there are many excellent State laboratory certification programs in

operation. This manual is not intended to regulate, impede, or degrade existing or future State certification programs. States without certification programs are encouraged to use this manual; States with equivalent or better certification programs are encouraged to continue and improve. The EPA welcomes any comments or suggestions which will improve this manual.

Sincerely yours,

Douglas M. Costle

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(June 1978)

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FEDERAL FACILITIES

Federal Facilities must comply with all Federal, State and local requirements with respect to the Safe Drinking Water Act. For the purposes of certification, Federal laboratories which conduct routine monitoring of public drinking water supplies are to be considered Local Laboratories and will be certifiable under a State program. The agency with primary enforcement authority, either the State or the Region acting as the surrogate State, will also be responsible for carrying out the interim certification guidance contained in this manual and will conduct on-site evaluations of the Federal facilities. EPA, however will have primary enforcement authority over any facilities on Indian lands.

Principal Federal Laboratories

While it is the responsibility of States to certify all Federal laboratories which analze large numbers of drinking water samples for compliance purposes, the EPA Region in which the Principal Federal Laboratory is physically located will conduct on-site evaluations if requested by a State with primary enforcement responsibility. Requests for this technical assistance should be made by the States to the appropriate Regional Administrator. EPA believes that this service may be of benefit to States that do not wish to certify Federal laboratories.

NOTE:

The Office of Water Supply has been renamed the Office of Drinking Water

MANUAL FOR THE INTERIM CERTIFICATION OF LABORATORIES INVOLVED IN ANALYZING PUBLIC DRINKING WATER SUPPLIES

Criteria and Procedures

September 1977

Prepared by

THE WATER SUPPLY QUALITY ASSURANCE

WORK GROUP

THE U.S. ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

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DISCLAIMER

This manual has been reviewed by the Office of Monitoring and Technical Support and the Office of Water Supply and approved for publication. The mention of commercial products does not constitute endorsement by the U.S. Environmental Protection Agency.

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ABSTRACT

Section 1401(1) of the Safe Drinking Water Act (SDWA), Public Law 93-523, defines "primary drinking water regulations" to include "quality control and testing procedures" to ensure compliance with maximum contaminant levels. Pursuant to the Act, the National Interim Primary Drinking Water Regulations (NIPDWR), 40 CFR 141 and 142 require that for compliance purposes, "samples" will be considered only if they have been analyzed by a laboratory approved by the State except that measurement for turbidity and free chlorine residual may be performed by any person acceptable to the State, and the States must establish and maintain a program for certification of laboratories conducting measurements of drinking water contaminants. This manual describes evaluation procedures and minimum technical requirements recommended for certifying laboratories analyzing public drinking water supplies. In addition to identifying requirements that are critical to the generation of valid data, optional certification requirements have been included as guidance.

In formulating an implementation strategy, EPA fully recognizes that there are many excellent State laboratory certification programs in operation. EPA is also aware that the capabilities of State and local laboratories vary greatly, and that a phased implementation program may be necessary to permit moving toward our goal without creating artificial impediments to the attainment of State primacy. This manual describes how EPA will carry out a program for interim approval and certification of its 10 Regional laboratories and principal State laboratories. States without certification programs are encouraged to use this program as a model; States with equivalent or better certification programs are encouraged to continue and improve. EPA welcomes any comments or suggestions that will improve this manual.

Chapter I

INTRODUCTION

As of June 24, 1977, all public water systems serving 25 persons or more must conform with provisions of the Safe Drinking Water Act (P.L. 93-523) and requirements contained in the National Interim Primary Drinking Water Regulations (40 CFR 141 and 142). In addition to prescribing maximum allowance levels and monitoring frequencies for various materials in drinking water, section 141.28 of the Interim Primary Regulations requires that all testing, except for turbidity and chlorine residual, be performed by laboratories approved by either the U.S. Environmental Protection Agency (EPA) or the States.

This manual is intended to assist in implementation of section 141.28 by providing a mechanism for approval of laboratories to assure the validity and quality of the data being developed for compliance with the regulations. The ultimate test of a laboratory is the validity and quality of its data. However, it is also important that certain minimum technical needs be met to assure that the laboratory has the necessary facilities and capabilities to consistently produce data acceptable under the terms of the regulations.

Formal certification of a laboratory under regulatory authority is the preferred approach of a certification program. However, since the Interim Primary Regulations are already in effect, time does not permit development of a regulatory approach to laboratory certification. Instead, a phased approach has been selected. In the first phase, to provide acceptable data for immediate implementation of the Interim Primary Regulations, Interim Approval will be granted laboratories on an administrative basis. Later, after an on-site evaluation based on this manual or its equivalent, Interim Certification will be granted. The major emphasis of this phase is to provide advice and technical assistance to the laboratories so that they can meet the requirements of Certification.

EPA's certification program calls for on-site evaluation of Principal Laboratories every 3 years and an annual performance evaluation of all laboratories analyzing public water supplies under the Safe Drinking Water Act. The annual performance evaluation, which is the most critical part of the certification program, involves providing water supply laboratories with unknown samples for analysis. If the laboratory fails to perform acceptably on these samples, it may be denied certification.

To renew the initial certification at the end of 3 years, a water supply laboratory must pass another on-site evaluation, as well as a review of its quality control program and its annual laboratory performance records.

EPA will consider developing revised regulations covering the certification of water laboratories in the future. However, such regulations will not be adopted until the interim program has been thoroughly reviewed and all elements of the program have been subjected to public comment.

The Office of Water Supply, EPA, which is responsible for implementation of drinking water regulations, believes that the criteria contained in this manual are appropriate for evaluation of all

water laboratories engaged in analyses relating to the Interim Primary Regulations. However, these criteria in general should be considered as guides to the on-site evaluation; only the methods and procedures in the Interim Primary Regulations or otherwise approved by EPA should be considered as mandatory for Interim Certification of a laboratory.

Chapter II of this manual outlines the Interim Certification Program, while Chapter III delineates responsibilities within EPA and describes how the program will be operated. The next three chapters cover technical requirements for conducting on-site evaluations of chemical, microbiological, and radiochemical laboratories. Various terms used in the manual are defined in the appendix.

Chapter II
INTERIM CERTIFICATION PROGRAM

Enforcement of the Safe Drinking Water Act and Interim Primary Regulations rests primarily with the States. To receive primary enforcement responsibility, a State must meet provisions of 40 CFR 142 (see Table II-1). In States not receiving primary enforcement responsibility, called "non-primacy States," the EPA Regional Office assumes the responsibility. Federal laboratories will be certified by the agency with primary enforcement responsibility.

A State seeking primary enforcement responsibility must apply to EPA through its Regional Office. In its application, a State must indicate that it meets the conditions for primacy including

Table II-1.—*Definition of primary enforcement responsibility*

According to 40 CFR 142.10(b) (3) and (4), a State has primary enforcement responsibility if it:

(b) Has adopted and is implementing adequate procedures for the enforcement of such State regulations, such procedures to include:

(3) The establishment and maintenance of a State program for the certification of laboratories conducting analytical measurements of drinking water contaminants pursuant to the requirements of the State primary drinking water regulations including the designation by the State of a laboratory officer, or officers, certified by the Administrator, as the official(s) responsible for the State's certification program. The requirements of this paragraph may be waived by the Administrator for any State where all analytical measurements required by the State's primary drinking water regulations are conducted at laboratories operated by the State and certified by the Agency. Until such time as the Agency establishes a National quality assurance program for laboratory certification the State shall maintain an interim program for the purpose of approving those laboratories from which the required analytical measurements will be acceptable.

(4) Assurance of the availability to the State of laboratory facilities certified by the Administrator and capable of performing analytical measurements of all contaminants specified in the State primary drinking water regulations.

Until such time as the Agency establishes a National quality assurance program for laboratory certification the Administrator will approve such State laboratories on an interim basis.

the designation of a Principal State Laboratory (or laboratories) to be responsible for analysis of all contaminants covered by the National Interim Primary Drinking Water Regulations.

In cases where the Principal State Laboratory must rely on another laboratory (called a Local Laboratory) to perform some of the analyses, the State must develop a certification program for Local Laboratories before primary enforcement responsibility can be granted.

EPA's Environmental Monitoring Support Laboratory in Cincinnati, Ohio (EMSL-CI), will initiate the national Interim Certification program for water supply laboratories by determining that EPA's Regional Offices and their laboratories have the capability to carry out the chemistry and microbiology portions of the program. Once this decision has been made, the Regions are ready to perform the on-site evaluations required for certification of Principal State Laboratories. In non-primacy States, the Regions will conduct the evaluations and grant certification to Local Laboratories. Since certification of a Principal State Laboratory may affect primary enforcement responsibility, the State must be notified of any adverse action and given the opportunity for a hearing as provided in 40 CFR 142, National Interim Primary Drinking Water Regulations–Implementation.

Since few if any EPA Regions have the expertise to certify radiochemistry laboratories, the Environmental Monitoring and Support Laboratory in Las Vegas, Nev. (EMSL-LV), will assume the same responsibilities that the Regions have for chemistry and microbiology.

The tentative schedule for laboratory certification is shown in Table II-2.

Table II-2.—*Tentative schedule for certification of laboratories*

Interim Approval	Starting June 24, 1977
EMSL-Cincinnati grants Interim Approval to Regional certification programs.	
Regions grant primary enforcement responsibility to qualified States. In States not qualified, the responsibility is assumed by the Regions.	
States with primary enforcement responsibility grant Interim Approval to Local Laboratories.	
Regions with primary enforcement responsibility grant Interim Approval to Local Laboratories.	
Interim Certification	by December 1978
EMSL-Cincinnati completes on-site evaluations and grants Interim Certification to Regional Laboratories.	
Regions complete on-site evaluations of Principal State and Federal Laboratories using this manual.	
States with primary enforcement responsibility begin to conduct on-site evaluations of Local Laboratories using this manual or one prepared by a State.	
Regions with primary enforcement responsibility begin to conduct on-site evaluations of Local Laboratories using this manual.	
Certification	1979-1980[1]
All water supply laboratories are certified using this manual or one prepared by a State.	

[1]Estimated effective date of National Revised Primary Drinking Water Regulations.

CERTIFICATION IN STATES WITH PRIMARY ENFORCEMENT RESPONSIBILITY

Present Federal regulations regarding laboratory certification in States seeking primary enforcement responsibility (section 142.10(b) (3), (b) (4)) require that the States' laboratory facilities be certified by EPA and be capable of analyzing all regulated contaminants in drinking water. These regulations also require that a State with Local Laboratories appoint a laboratory officer(s), certified by EPA, as the official(s) responsible for the State's certification program. It is highly desirable that one officer in each State be responsible for the program.

After a State has received primary enforcement responsibility, it must request an on-site evaluation of its Principal Laboratory by writing to its EPA Regional Office. The letter should include the following information:

- Name and location of each facility to be evaluated.
- Name, address, and telephone number of the supervisor, manager, or director for each facility to be evaluated.
- Specific analysis for which certification is requested.
- A recommended date, not less than 60 days after submission of the request, for the on-site evaluation.

The on-site evaluation will be conducted in each analysis, and the criteria contained in this manual will be used to determine if a laboratory qualifies for Interim Certification.

State Program for Certification of Local Laboratories

Local Laboratories covered by the State certification program may be any State, county, city, Federal, utility, or commercial laboratory. Implementation of the State's certification program may be accomplished on a phased basis with respect to time (Table II-2). However, at a time agreed to by the Region and the State, but not later than December 1978, the State must begin to conduct on-site evaluations of Local Laboratories. Certification must be based upon criteria contained in this manual or State-developed equivalents that contain requirements at least as stringent as those used in the evaluation of Principal State Laboratories. *All* laboratories must be certified by October 1980.

Reciprocity

EPA endorses reciprocity as a highly desirable element in the certification program for water supply laboratories. As implementation of the Safe Drinking Water Act proceeds, EPA encourages States to adopt provisions in their laws and regulations to permit interstate reciprocity.

CERTIFICATION IN STATES WITHOUT PRIMARY ENFORCEMENT RESPONSIBILITY

In keeping with the provisions of section 141.28, water supply laboratories in States without primary enforcement responsibility will be certified on an interim basis by the Region. In addition to its laboratory certification duties, the Region and its laboratory will have administrative, enforce-

ment, and local laboratory certification responsibilities that would normally be performed by the State. Some of these tasks may be redelegated to the State, but the Region must retain responsibility for on-site evaluation of the designated Principal State Laboratory. Local Laboratories may be evaluated by the Region or under a Region-approved program carried out by a designated Principal State Laboratory. Regions will determine if laboratories in a State without a certification program qualify for certification to perform analyses for a nonprimacy State (the establishment of a fee schedule is being considered for this type of certification). In any case, this manual shall provide the basis for the on-site evaluation.

Local Laboratories

Regions will probably have awarded Interim Approval to laboratories having the capability to analyze drinking water in conformance with the analytical methods cited in the Interim Primary Regulations or otherwise approved by EPA. As soon as possible thereafter, the Region should begin to certify the laboratories on an interim basis using this manual. The Regions should first award Interim Approval to eligible Principal State and Local Laboratories and begin by December 1978 to conduct on-site evaluations of laboratories. All laboratories must be certified by October 1980.

Reciprocity

Laboratories fully certified by EPA for specific analyses will be acceptable under the Safe Drinking Water Act in all other jurisdictions where EPA has primary enforcement responsibility. This de facto reciprocity does not apply to those States which accept primary enforcement responsibility.

FEDERAL FACILITIES

Where States have drinking water regulations virtually identical to the National Interim Primary Drinking Water Regulations, States may have jurisdiction over Federal facilities with respect to the Safe Drinking Water Act. EPA, however, expects to have primary enforcement authority over most Federal and Indian facilities. For the purpose of laboratory certification, the agency with primary enforcement authority will also be responsible for carrying out the interim certification guidance contained in this manual and will conduct on-site evaluations of the laboratory facilities.

Principal Federal Laboratories

Principal Federal Laboratories that analyze large numbers of drinking water samples from interstate water supplies will be evaluated on-site by the EPA Region where the laboratory is physically located. EPA believes that good policy and reasonable regulatory procedure dictates that samples analyzed by any Federal laboratory approved by EPA using this manual should be acceptable to State certification programs under the Safe Drinking Water Act.

Local Federal Laboratories

Local Federal Laboratories are approved and certified on an interim basis by either the State or EPA, whichever has primary enforcement responsibility.

Chapter III

OPERATIONAL GUIDANCE FOR EPA REGIONS

This chapter is primarily directed to the 10 EPA Regions and is intended to describe how EPA will manage its interim certification program for water supply laboratories. A State with Local Laboratories must maintain a certification program to receive primary enforcement responsibility. States without certification programs may use this guidance as a model; States are encouraged to continue to improve current programs that are equivalent to or better than what is described in this chapter. However, EPA does not anticipate that all State certification programs will be identical to the one described here.

RESPONSIBILITIES

The success of the laboratory certification program depends on genuine cooperation among the organizations responsible for implementing the intent of the program and for establishing the procedures and guidelines that will be followed. Within EPA, primary responsibilities for laboratory certification are shared by the Office of Water Supply (OWS), the Office of Monitoring and Technical Support (OMTS), and the EPA Regional Offices.

Office of Water Supply (OWS)

OWS is responsible for management of the national certification program for public drinking water systems and for implementation of the Safe Drinking Water Act, including preparation of regulations and standards.

Office of Monitoring and Technical Support (OMTS)

OMTS is responsible for developing and implementing an EPA-wide quality assurance program, including laboratory certification. Actual development and operation of the quality assurance effort is conducted by the Environmental Monitoring and Support Laboratory in Cincinnati, Ohio (EMSL-CI), and the one in Las Vegas, Nev. (EMSL-LV).

EMSL-CI has been designated as the national focal point for Interim Certification of water supply laboratories making chemical and microbiological measurements. It evaluates the resources and personnel available in each EPA Region, then makes recommendations to the EPA Assistant Administrator, Office of Research and Development (ORD), on their ability to carry out the national program. Should a Region not have the resources or personnel to certify laboratories in each technical area, it must make arrangement with OMTS. Among the duties of EMSL-CI are:

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- Approve Regional programs to certify Principal State Laboratories and conduct on-site evaluation of Regional Laboratories at 3-year intervals.
- Conduct annual performance evaluations for all Principal State Laboratories and the Regions. Other laboratories may participate as approved by the Regions/States.
- Review Regional certification program and laboratory performance records annually.
- Review the overall certification program annually.
- Maintain liaison with the Regional Water Supply Divisions regarding the technical assistance they provide the States.
- Develop and participate in training courses to support the certification program.
- Provide technical assistance as required.

EMSL-CI will renew approval of the Region and its laboratory at 3-year intervals. Renewal criteria include an annual program review, an annual review of laboratory performance records, and the on-site evaluation of the laboratory conducted every 3 years.

EMSL-LV has been designated as the national focal point for Interim Certification of water supply laboratories making radiochemical measurements. Its duties correspond with those described for EMSL-CI. EMSL-LV will assume responsibility for both on-site inspections and performance evaluations for radiochemistry capabilities of all Principal State Laboratories and other laboratories not covered by State programs provided resources are available.

EPA Regional Offices

EPA's 10 Regional Offices have primary responsibility for implementing the water supply certification program. This responsibility includes review, approval, and overview of State laboratories and certification programs to assure compliance with conditions for assumption of primary enforcement responsibility. Also, the Regions will be responsible for on-site evaluation and certification of Principal State Laboratories; however, Regional evaluation teams must be certified by OMTS prior to conducting evaluations. Specific duties of the Regions include:

- Approve State programs to certify local laboratories.
- Conduct on-site evaluations of Principal State Laboratories.
- Coordinate performance evaluations for all laboratories in the Region.
- Participate in the annual review of State certification programs and performance evaluation reports.
- Provide technical assistance to water supply laboratories that need to be upgraded.
- Operate certification program in nonprimacy States, including Interim Approval and Certification of Federal laboratories.

EMSL-LV will renew certification of Principal State Laboratories at 3-year intervals. Renewal criteria include annual performance records and an on-site evaluation conducted during the year of renewal.

Water Supply Advisory Committee for Laboratory Certification

An advisory committee will be established to oversee operation of the national certification program. This committee should include representatives from the Office of Water Supply, Office of Monitoring and Technical Support, Office of Radiation Programs, Office of Enforcement,

Environmental Monitoring and Support Laboratories, Water Supply Research Laboratory, Regional Offices, and States. This committee will review and advise on program operation, revise and resolve technical and administrative problems, and revise evaluation and acceptance procedures as dictated by experience or more current information.

INTERIM CERTIFICATION OF REGIONS

EPA Regions must be certified by EMSL-CI prior to exercising their authority to certify Principal State Laboratories and Local Laboratories in nonprimacy States. Certification of the Regions will be based on the availability of a qualified individual to direct the laboratory certification program, an on-site evaluation team, and a laboratory capability for conducting all of the analyses required by the Interim Primary Regulations. In addition, the Regions are required to have a written plan for certifying Local Laboratories in nonprimacy States. EMSL-CI must approve such laboratory certification plans. Certification requirements are discussed below.

Individual(s) Responsible for Certification Program

A Regional coordinator of laboratory certification/quality assurance responsible for water supply must be designated. This individual must be experienced in quality assurance; hold an advanced degree or have equivalent experience in microbiology, chemistry, or radiochemistry; and have sufficient administrative and technical stature to be considered a peer of the director of the Principal State Laboratory.

On-Site Evaluation Team

One or more teams must be designated to evaluate a laboratory in microbiology and chemistry. Team members must be experienced professionals, qualified to certify a laboratory and holding at least a bachelor's degree in the specific discipline. Team members must participate in a training course in the proper use of procedures and criteria for evaluating and certifying laboratories. Courses include formal lectures on the criteria document, a mock laboratory evaluation, preparation of an evaluation report, and the participant's recommendations as to certification status for the mock laboratory evaluated. The performances of the course participants will determine their eligibility for certification.

A representative from the Regional Water Supply Division should be appointed to the evaluation team to evaluate activities outside the direct control of the laboratory that impact the validity of its data. However, those activities cannot be used for certification purposes.

Only chemists and microbiologists are planned for certification at this time.

Regional Laboratories

Regional Laboratories that may be required to analyze potable water samples under the Safe Drinking Water Act must meet the minimum requirements in this current manual, pass an on-site inspection at least once every 3 years, and pass an annual evaluation of performance.

Regional Plans for Certification of Local Laboratories

Regions must develop plans for Interim Approval and Interim Certification of Local Laboratories and Federal Laboratories in nonprimacy States, as appropriate. Written plans should include the following:

- Certification official
- Types and numbers of laboratories (identify radiochemical laboratories and provide addresses)
- Analyses to be covered, including turbidity and, if allowed, chlorine residual
- Schedule for Interim Approvals and on-site evaluations
- Plans for providing technical assistance to laboratories in need of upgrading

EMSL-LV will be responsible for both on-site inspections and performance evaluations of radiochemistry laboratories. All plans for Interim Approval and Certification of radiochemistry laboratories must be coordinated with EMSL-LV.

INTERIM CERTIFICATION OF PRINCIPAL STATE LABORATORIES–CHEMISTRY AND MICROBIOLOGY

Interim Certification of Principal State laboratories starts when the State makes a formal request to the Region stating the type of analysis to be evaluated. The Principal State Laboratory and its Local Laboratories must have the capability of performing all analyses; however, an individual laboratory which is a part of a principal State laboratory may be certified for only one, several, or all of the analyses included in the Interim Primary Regulations. A request for certification of a laboratory for which the Region has jurisdiction should come from the laboratory director. The Region should respond within 30 days, and a mutually agreeable date and time should be set for laboratory evaluation.

Before conducting the on-site evaluation, the Region shall:

- Hold a pre-evaluation conference with appropriate laboratory and field activity representatives to establish a schedule that would have a minimum impact on the laboratory activities.
- Request that a variety of tests be scheduled during the on-site evaluation.
- Arrange for the laboratory staff to be available during the on-site visit.

During the on-site visit, the team shall:

- Evaluate the procedures and equipment used for those specific analyses for which the laboratory has requested certification.
- Review the records and written standard procedures for compliance with the required sampling frequency; check sampling program, sample transit time, and resample notices, if appropriate.
- Evaluate the Principal Laboratory's quality control program to determine:

  –Does the laboratory have a quality control program in effect?

- –Do quality control data show that this program is being implemented?
- –Do the data show that the laboratory is producing valid results?

- Examine and document general procedures including the following items:

  - –Sampling location guidance
  - –Sampling procedures
  - –Sample identification
  - –Prompt transport of sample to laboratory
  - –Sample frequency
  - –Follow-up of positive samples
  - –Dissemination of data

  Note: This information should be obtained by the Water Supply Division's representative on the team and be included in the narrative report that is forwarded to the State; however, only those items in the above list for which the laboratory is directly responsible shall affect certification.

- Complete the on-site evaluation form during the visit.
- Review the results of the evaluation with the director of the laboratory, the director of field activities, and appropriate staff members. The review should:

  - –Discuss deviations in the observed procedures and records.
  - –Recommend procedural changes in equipment and supply needs, staffing requirements, and facility improvements, as necessary.

- Conclude with a discussion of how the Region can aid the laboratory.

After the on-site visit, the Region can take one of three actions for each analysis involved:

- Certified (interim)–a laboratory that meets the minimum requirements as determined by the evaluation team using this manual. The certification shall be for 3 years.
- Provisionally certified (interim)–a laboratory that has been given a grace period of up to 1 year to correct deficiencies. In no case should provisional certification be given if the evaluation team believes that the laboratory lacks the capability of performing the analysis. Laboratories placed in this category must be reevaluated unless they can document in some other way that the deficiency has been corrected.
- Not certified–a laboratory that does not meet the minimum requirements as determined by the evaluation team using this manual. A laboratory in this category may appeal to the Regional Administrator by requesting reevaluation by another Regional team or by a team from another EPA laboratory. Should the reevaluation confirm the "not certified" classification, the laboratory must correct the major deficiencies noted and then request reevaluation, or the State can request that another laboratory be evaluated to perform the analysis.

INTERIM CERTIFICATION OF RADIOCHEMISTRY LABORATORIES

Since few if any Regions have the expertise required to certify radiochemistry, EMSL-LV will assume primary responsibility for both performance evaluation and on-site inspection of radio-

chemistry capabilities of Principal Laboratories. When the Region has established plans for on-site evaluation of State laboratories, it should request an evaluator from the Director, EMSL-LV. Since manpower resources are limited, the request should be submitted at least 1 month prior to the scheduled visit(s). Whenever possible, several tentative dates should be submitted, and several visits scheduled within the same time period. If necessary, the radiochemists will carry out their part of the evaluation independent of the Regional team. In scheduling on-site visits, every effort will be made to assist and give priority to those Regions with special problems.

If a State, or a Region acting on behalf of a State, is using or plans to use a private laboratory for all or part of the radioanalysis required by the National Interim Primary Drinking Water Regulations, an on-site evaluation of the private laboratory is necessary. To facilitate visits to a private laboratory, a written agreement, granting permission to carry out an on-site evaluation, should exist between the State (or Region) and the laboratory to be evaluated.

All of the State laboratories involved should be urged to participate in all EMSL-LV performance studies involving analysis of all radionuclides in water for which they wish to be certified.

The procedures used for on-site evaluation of radiochemistry laboratories generally will be the same as used for chemistry and microbiology. All laboratories will be encouraged to participate in EPA's quality assurance program.

EPA'S QUALITY ASSURANCE PROGRAM

Documenting the ability of a laboratory to consistently produce valid data is the primary goal of the certification effort. Quality assurance is the backbone of the entire program. EPA will provide two types of samples to Regional and Principal Laboratories. Until EPA provides these samples, Interim Certification will be based on the results of the on-site evaluation and the laboratory's internal quality control program.

Calibrated Reference Materials and Quality Control Samples

Known-value quality control samples for microbiology and chemistry will be developed and furnished by EMSL-CI directly to Regions and through the Regions to state and local laboratories. Calibrated radioactive samples will be provided by EMSL-LV. The known-value samples are to be used by the laboratories as independent checks on reagents, instruments, or techniques; for training analysts; or for comparative analysis within the laboratory. However, these samples are not intended to replace routine check samples or standards run as part of an internal quality control program. Although no certification or other formal evaluation function directly results from the use of these samples, their routine use will provide evidence that an acceptable laboratory quality control program is in operation. Requests for samples should be made through the appropriate EPA Regional Office.

Performance Evaluation Samples

Appropriate performance evaluation samples will be furnished to all Principal Laboratories as part of the Interim Certification program. Unacceptable performance will serve as a basis for denying the laboratory certification. In such cases, however, appropriate technical assistance, as well as

additional performance samples, will be provided to the laboratory. Reexamination may be required if key analysts leave a particular laboratory during the 3-year certification period.

EVALUATION REPORT FOR PRINCIPAL LABORATORIES

A formal narrative report and action memorandum shall be prepared for the Regional Administrator. This report should contain all information pertinent to the evaluation and also recommend the analyses for which Interim Certification can be awarded. The report should then be forwarded for evaluation to the Regional director of laboratory certification/quality assurance and the Regional director of the Water Supply Division. After considering the report, they should transmit it to the Regional Administrator for his action.

The Regional Administrator should advise the State within 30 days if the laboratory is certified and forward the complete report to the State. If the report recommends that the laboratory not be certified for an analysis, the Regional Administrator should give the specific reasons. The State may appeal to the Region. At that time the Region should arrange for a reevaluation of the laboratory by another Regional team or a team from another EPA laboratory. A decision should be forwarded to the Regional Administrator within one month. In the meantime, the Principal Laboratory may continue to operate on a provisional status. Should the reevaluation support the Regional Administrator's decision, the data produced by the laboratory will be considered invalid until the laboratory has achieved Interim Certification.

The narrative report should be prepared and attached to each copy of the completed evaluation form. It should include the general headings and information listed below:

Title Page

The title page should contain the following:

Report of an on-site evaluation of the

(name of laboratory)

at (street address)

(city, State, and zip code)

on (date)

by

(name, title, organization,

and address

of the certification team)

Introduction

The introduction might read:

> **The equipment and procedures employed in the bacteriological, chemical, and radiochemical analyses of water by this laboratory conformed with provisions of the Manual for Interim Certification of Water Supply Laboratories, except for the items indicated.**

List of Deviations

List each deviation by item number used on the evaluation form; describe exact deviation; recommend procedural change for compliance with standard procedure.

Remarks

Include comments on procedures, description of unusual tests, or other remarks. If there are no remarks, delete heading.

Commendation

List any items or persons deserving special commendation. Reserve such commendation for outstanding performance. If no commendation is appropriate, delete the heading.

List of Personnel

List name and title of personnel along with the individual tests that each normally performs.

Conclusions

Give descriptive conclusion, including recommendation for approval or rejection of results of the laboratory. Except in unusual circumstances, one of the three conclusions below should apply to any laboratory.

- Conclusion A—unqualified acceptance; Interim Certification is recommended. Example:

  > **The procedures and equipment in use at the time of this evaluation were in complete compliance with provisions of the manual for Interim Certification of Water Supply Laboratories. We recommend that the analytical data be accepted for the following analysis of waters under the Safe Drinking Water Act. (List.)**

- Conclusion B—qualified acceptance; provisional certification is recommended if the team believes that the deviations do not seriously affect the validity of results and that they will be corrected immediately. This conclusion can be made more restrictive, when necessary, by the words "pending correction of deviations" or other appropriate wording. Example:

The procedures and equipment in use at the time of the evaluation complied in general with the provisions of the Manual for Interim Certification of Water Supply Laboratories. When the deviations listed are corrected, we recommend that the results be accepted for the following analyses of waters under the Safe Drinking Water Act. (List.) We suggest that after the listed deviations have been corrected, this laboratory request another evaluation, or otherwise document their correction.

- Conclusion C--due to the lack of equipment or use of inappropriate techniques, or other causes, laboratory results are unacceptable. Example:

The procedures and equipment in use at the time of this evaluation showed unacceptable deviations from the Manual for Interim Certification of Water Supply Laboratories. We recommend that analytical data from this laboratory not be accepted for the following analysis of waters under the Safe Drinking Water Act. (List.) We suggest that this laboratory request another evaluation after the listed deviations have been corrected.

Laboratory Certification

List either certified (interim), provisionally certified (interim), or not certified for each technical area of analysis performed. The evaluation team must sign the report.

Distribution

Copies of this report should be distributed to the State requesting the evaluation, EMSL-Cincinnati, and the Office of Water Supply.

Chapter IV

CHEMISTRY: CRITERIA AND PROCEDURES FOR INTERIM CERTIFICATION OF LABORATORIES INVOLVED IN ANALYSIS OF PUBLIC WATER SUPPLIES

The criteria and procedures contained herein in **bold** are the minimum requirements considered essential for laboratories seeking certification for chemical analysis of public water supplies. They include methodology and required equipment, collecting, handling, and preserving samples, and quality control. The other items, involving personnel, laboratory facilities, laboratory equipment and instrumentation specifications, general laboratory practices, data reporting, and action response, are optional.

Until National Revised Primary Drinking Water Regulations require mandatory certification of water supply laboratories, all specifications will be considered as guidelines to be used by certification officials. At that time, minimum requirements will be essential to certification of laboratories involved in analysis of public water supplies.

A laboratory that exceeds these requirements is encouraged to maintain and improve its higher standards for facilities, equipment, instrumentation, and quality control. Upgrading of personnel should be an ongoing process involving training efforts to ensure continued production of reliable data.

Minimum requirements are shown throughout in **bold**.

PERSONNEL[1] (OPTIONAL REQUIREMENTS)

Analyst for Routine Tests (all chemical measurements other than organic chemicals)

Requirements for the routine test analyst position are:

- *Academic training:* Minimum of high school diploma or its equivalent (State certification or licensing may be considered).
- *Experience:*[2]

  –Minimum of 2 years of experience in inorganic measurements, including 6 months of on-the-job training, under direct supervision of qualified analyst, in measurements being considered for certification.

[1] Exceptions will be made for those persons employed by the laboratory and currently doing the required analyses prior to promulgation of the interim regulations provided that within 2 years after June 24, 1977, they receive a minimum of 2 weeks of additional training in water chemistry.

[2] Each year of college-level training in related scientific fields or demonstrated equivalency shall be considered equal to 1 year of work experience. Such a substitution should not exceed one-half of the required experience.

Preceding page blank

–With no experience, 2 years of on-the-job training, under direct supervision of a qualified analyst, in measurements being considered for certification.

Analyst for Organic Chemicals

Requirements for the organic chemicals analyst position are:

- *Academic training:* Minimum of high school diploma or its equivalent.
- *Experience:*[1] Minimum of 6 months of experience in measurement of chlorinated hydrocarbons and chlorophenoxys and 2 years of experience in gas chromatography.
- *Supervision:* Supervision by an analyst (also eligible to analyze for organic chemicals) who has

  –A professional degree or its equivalent, with 1 year of course work in organic chemistry.
  –1 year of experience in measurement of organic chemicals by gas chromatography.

Supervisor/Consultant

Requirements for the supervisor/consultant are:

- *Academic training:* Minimum of bachelor's degree in chemistry or its equivalent.
- *Experience:* Minimum of 2 years of experience in measurements being considered for certification.

Laboratory Director[2]

Requirements for the laboratory director are:

- *Academic training:* Minimum of bachelor's degree in chemistry or its equivalent.
- *Experience:* Minimum of 5 years of experience.

LABORATORY FACILITIES

Optional Requirement

Laboratory space should be adequate (150 to 200 ft^2/person, regardless of test, is recommended). It should contain approximately 15 linear ft of usable bench space and include the following:

Minimum Requirements

- **Sink with hot and cold running water.**
- **Electricity.**

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[1] Each year of college-level training in related scientific fields or demonstrated equivalency shall be considered equal to 1 year of work experience. Such a substitution should not exceed one-half of the required experience.
[2] These positions may not be necessary in smaller laboratories; however, a consultant should be available.

- Source of distilled and/or deionized water (depending on parameters measured).
- Exhaust hood or equivalent for analysis of organic chemicals and trace metals.

LABORATORY EQUIPMENT AND INSTRUMENTATION SPECIFICATIONS (MINIMUM REQUIREMENTS)

Only those instruments should be required that are needed to analyze for the substances for which the laboratory is being certified, but those instruments should meet the following specifications. A laboratory doing all of the required analyses should have, or have access to, all of the following equipment with the minimum specifications cited.

- *Analytical balance:* Should provide sensitivity of at least 0.1 mg.
- *Photometer* (see Table IV-1 below for instrumentation for individual methods):

  – *Spectrophotometer:* Usable wavelength range, 400 to 700 nm. Maximum spectral bandwidth, no more than 20 nm. Wavelength accuracy, 0 ± 2.5 nm. Photometer should be capable of using several sizes and shapes of absorption cells providing a sample path length varying from approximately 1 to 5 cm.

  – *Filter photometer* (abridged spectrophotometer): Capable of measuring radiant energy in range of 400 to 700 nm. Relatively broad bands (10 to 75 nm) of this radiant energy are isolated by use of filters at or near the maximum absorption of the colorimetric methods. Photometer should be capable of using several sizes and shapes of absorption cells providing a sample path length varying from approximately 1 to 5 cm.

- *Magnetic stirrer:* Variable speed, 120 V, with Teflon-coated stirring bar.
- *pH Meter:* Accuracy, ± 0.05 units. Scale readability, ± 0.1 units. Laboratories purchasing a new pH meter are strongly advised to purchase one capable of functioning with specific ion electrodes (see following item). Unit may be line/bench or battery/portable operated.
- *Specific ion meter:* Readable and accurate to ± 5 mV. Unit may be line/bench or battery/portable operated.
- *Atomic absorption spectrophotometer:* Single-channel, single- or double-beam instrument having a grating monochromator, photomultiplier detector, adjustable slits, a wavelength range of 190 to 800 nm, and provisions for interfacing with a strip chart recorder.
- *Recorder for atomic absorption:* Strip chart recorder having a chart width of 10 in or 25 cm, a full scale response time of 0.5 s or less, 10- or 100-mV input to match the instrument, and variable chart speeds of 5 to 50 cm/min, or equivalent.
- *Gas chromatograph (equipped with an electron-capture detector):* A commercial or custom-designed gas chromatograph with a column oven capable of isothermal temperature control to at least 210° ± 0.2° C. System should be equipped with accurate needle-valve gas-flow controls, accept 1/4-in glass columns with the option of direct on-column injection. System must be demonstrated to be suitable for chlorinated hydrocarbon pesticides, with a minimum of decomposition and loss of compounds of interest.

- *Recorder for gas chromatograph:* Strip chart recorder having a chart width of 10 in or 25 cm, a full scale response time of 1 s or less, 1-mV (−0.05 to 1.05) signal to match the instrument, and variable chart speeds of 5 to 50 cm/min or equivalent.
- *Conductivity meter:* Suitable for checking distilled water quality. Should be readable in ohms or mhos, have a range of 2 to 2.5 million ohms or equivalent micromhos ± 1 percent, and have a sensitivity of 0.33 percent or better. Unit may be line/bench or battery/portable operated.
- *Drying oven:* Gravity and mechanical convection units with selectable temperature control from room temperature to 170°C or higher.
- *Desiccator:* Glass or plastic models, depending on particular application.
- *Hot plate:* Large or small units with selectable temperature controls for safe heating of laboratory reagents.
- *Refrigerator:* A standard kitchen type domestic refrigerator for storage of aqueous reagents and samples. For storing organics and flammable materials, an "explosion-proof" type of refrigerator should be used. When refrigeration is not required, an explosion-proof cabinet may be used.
- *Glassware:* Should be of Pyrex or Kimax type glass, which is more resistant than regular soft glass to damage by heat, chemicals, and abuse. All volumetric glassware should be marked Class A, denoting that it meets Federal Specifications and need not be calibrated before use.
- *Stirred boiling water bath:* For ambient temperature to 100°C (with gable lid).

GENERAL LABORATORY PRACTICES (OPTIONAL REQUIREMENTS)

The following constitute requirements for general laboratory practices:

- *Prepackaged kit methods:* All kit procedures, other than the DPD Colorimetric Test Kit, are considered as alternative analytical techniques, and procedures described under section 141.27 of the National Interim Primary Drinking Water Regulations are to be followed.
- *Calibration intervals for color wheels, sealed ampules, and other visual standards:* Laboratories utilizing visual comparison devices should calibrate the standards incorporated into such devices at least every 6 months. These calibrations should be documented. Directions for preparing temporary and permanent type visual standards can be found in the appropriate sections of "Standard Methods for the Examination of Water and Wastewater," 14th edition, published in 1975 (or the latest edition published) by the American Public Health Association. By comparing standards and plotting such a comparison on graph paper, a correction factor can be derived and applied to all future results obtained on the now calibrated apparatus.
- *Glassware preparation:* All glassware should be washed in a warm detergent solution and thoroughly rinsed first in tap water and then in distilled water. This cleaning procedure is sufficient for most analytical needs, but the individual procedures should be referred to for more elaborate precautions to be taken against contamination of glassware. It has been found advantageous to maintain a separate set of glassware (suitably prepared) for the nitrate, mercury, and lead procedures due to the potentiality for contamination from the laboratory environment. All glassware used in organic chemical analyses should have a final

rinse with nanograde acetone or its equivalent and should then be air dried in an area free of organic contamination.

- *Distilled/deionized water:* Water having resistivity values between 0.5 to 2.0 megohms (2.0 to 0.5 micromhos)/cm at 25°C is satisfactory. Megohms are related to micromhos in the following manner:

$$\frac{1}{\text{megohms}} = \text{micromhos}, \qquad \frac{1}{\text{micromhos}} = \text{megohms}$$

  Excellent quality water has resistivity values exceeding 1.0 megohms/cm (less than 1.0 micromhos/cm) at 25°C. High quality water meeting such specifications may be purchased from commercial suppliers; laboratories should request a list of quality specifications for any water purchased. Quality of distilled/deionized water is best maintained by sealing from the atmosphere. Quality checks should be made at planned intervals and documented.
- *Chemicals/reagents:* "Analytical reagent grade" (AR) chemicals should be used for most analyses required of water treatment laboratories. Consult "Standard Methods for the Examination of Water and Wastewater," 14th edition, part 102, pages 5-8, or the latest edition of this reference, for more detailed information on reagent grades. Individual analytical procedures in "Standard Methods for the Examination of Water and Wastewater," and the EPA's "Methods for Chemical Analysis of Water and Wastes" often specify special requirements for the reagents to be used.
- *Laboratory safety:* While safety is not an aspect of laboratory certification, evaluators should point out, on an informal basis, potential safety problems observed during an on-site visit.

METHODOLOGY AND REQUIRED EQUIPMENT (MINIMUM REQUIREMENTS)

Table IV-1 shows minimum equipment requirements, methodology, and references for individual parameters. Equivalent equipment may be used. All other procedures are considered alternative analytical techniques as described in 40 CFR 141. Application for the use of alternative methods may require acceptable comparability data.

SAMPLE COLLECTING, HANDLING, AND PRESERVATION (MINIMUM REQUIREMENTS)

Table IV-2 shows requirements for container types, preservatives and holding times for individual parameters.

QUALITY CONTROL

Minimum Requirements

The requirements that appear on pages 25-26 are minimum for quality control.

Table IV-1.—*Minimum requirements—Methodology and required equipment*

Parameter	Methodology (unfiltered sample)	Reference (page number)		Major equipment required (or its equivalent)
		SM[1]	EPA[2]	
Arsenic[3]	Atomic absorption; gaseous hydride	–	95-96	Atomic absorption spectrophotometer with recorder
Barium	Atomic absorption	210-215	97-98	Atomic absorption spectrophotometer with recorder
Cadmium	Atomic absorption; chelation-extraction	210-215	101-103	Atomic absorption spectrophotometer with recorder
Chromium	Atomic absorption; chelation-extraction	210-215	105-106	Atomic absorption spectrophotometer with recorder
Lead	Atomic absorption; chelation-extraction	210-215	112-113	Atomic absorption spectrophotometer with recorder
Mercury	Flameless atomic absorption	–	118-126	Atomic absorption spectrophotometer with recorder or instrument designed specifically for measurement of mercury
Nitrate	Brucine colorimetric	461-464	–	Spectrophotometer or filter photometer
	Cadium reduction	–	201-206	Spectrophotometer
Selenium[3]	Atomic absorption; gaseous hydride	–	145	Atomic absorption spectrophotometer with recorder
Silver	Atomic absorption	210-215	146	Atomic absorption spectrophotometer with recorder
Fluoride	Electrode; distillation not required	172-174	65-67	Ion-selective electrode and expanded scale electrometer
	Colorimetric with preliminary distillation	171-172 174-176	59-60	Direct distillation apparatus and spectrophotometer or filter photometer
Chlorinated hydrocarbons: Endrin Lindane Methoxychlor Toxaphene	Gas chromatography	–	([4])	Kuderna-Danish glassware, gas chromatograph equipped with glass-lined injection port and electron-capture detector, and recorder
Chlorophenoxys: 2,4-D 2,4,5-TP	Gas chromatography	–	([4])	Kuderna-Danish glassware, gas chromatograph equipped with glass-lined injection port and electron-capture detector, and recorder

[1] "Standard Methods for the Examination of Water and Wastewater," 13th edition, American Public Health Association, 1971.

[2] "Methods for Chemical Analysis of Water and Wastes," U.S. Environmental Protection Agency, Office of Technology Transfer, Washington, D.C. 20460, 1974.

[3] Complete method available in: Caldwell, J. S., Lishka, R. J., and McFarren, E. F., "Evaluation of a Low Cost Arsenic and Selenium Determination at Microgram Per Liter Levels," J. Amer. Water Works Assoc., 65:731 (November 1973).

[4] Methods available from U.S. Environmental Protection Agency, Environmental Monitoring and Support Laboratory, Environmental Research Center, Cincinnati, Ohio 45268.

Table IV-2.—*Sample collecting, handling, and preservation*[1]

Parameter	Preservative[2]	Container[3]	Maximum holding time[4]
Arsenic	Conc HNO_3 to pH<2	P or G	6 months
Barium	Conc HNO_3 to pH<2	P or G	6 months
Cadmium	Conc HNO_3 to pH<2	P or G	6 months
Chromium	Conc HNO_3 to pH<2	P or G	6 months
Lead	Conc HNO_3 to pH<2	P or G	6 months
Mercury	Conc HNO_3 to pH<2	G P	38 days 14 days
Nitrate	Conc H_2SO_4 to pH<2	P or G	14 days
Selenium	Conc HNO_3 to pH<2	P or G	6 months
Silver	Conc HNO_3 to pH<2	P or G	6 months
Fluoride	None	P or G	1 month
Chlorinated hydrocarbons	Refrigerate at 4° C as soon as possible after collection	G with foil- or Teflon-lined cap	14 days[5]
Chlorophenoxys	Refrigerate at 4° C as soon as possible after collection	G with foil- or Teflon-lined cap	7 days[5]

[1]If a laboratory has no control over these factors, the laboratory director must reject any samples not meeting these criteria and so notify the authority requesting the analyses.

[2]If HNO_3 cannot be used because of shipping restrictions, sample may be initially preserved by icing and immediately shipping it to the laboratory. Upon receipt in the laboratory, the sample must be acidified with conc HNO_3 to pH<2. At time of analysis, sample container should be thoroughly rinsed with 1:1 HNO_3; washings should be added to sample.

[3]P = Plastic, hard or soft; G = Glass, hard or soft.

[4]In all cases, samples should be analyzed as soon after collection as possible.

[5]Well-stoppered and refrigerated extracts can be held up to 30 days.

- All quality control data must be available for inspection.
- Laboratory must analyze an unknown performance sample (when available) once per year for parameters measured. Results must be within the control limits established by EPA for each analysis for which the laboratory wishes to be certified. If problems arise, appropriate technical assistance will be provided, and a followup performance sample should be analyzed.

- **Minimum daily quality control:**

  - **After a standard reagent curve composed of a minimum of a reagent blank and three standards has been prepared, subsequent standard curves must be verified by use of at least a reagent blank and one standard at or near the MCL. Daily checks must be within ±10 percent of original curve.**
  - **If 20 or more samples per day are analyzed, working standard curve must be verified by running an additional standard at or near the MCL every 20 samples. Checks must be within ± 10 percent of original curve.**

Optional Requirements

The following quality control requirements are optional:

- Current service contract is in effect on all balances.
- Class S weights are available to make periodic checks on balances.
- Thermometer certified by the National Bureau of Standards (or one of equivalent accuracy) is available to check thermometers in ovens, etc.
- Color standards or their equivalent are available to verify wavelength settings on spectrophotometers.
- Chemicals are dated upon receipt of shipment and replaced as needed or before shelf life has been exceeded.
- Criteria have been established for a laboratory analyzing supply samples other than its own:

  - Laboratory should perform on a known reference sample (when available) once per quarter for the parameters measured. The measured value should be within the control limits established by EPA for each analysis for which the laboratory wishes to be certified.
  - At least one duplicate sample should be run every 10 samples, or with each set of samples, to verify precision of the method. Checks should be within the control limits established by EPA for each analysis for which the laboratory wishes to be certified.
  - Standard deviation should be calculated and documented for all measurements being conducted.
  - Quality control charts or a tabulation of mean and standard deviation should be used to document validity of data on a daily basis.

DATA REPORTING (OPTIONAL REQUIREMENTS)

Records of chemical analyses sould be kept by the laboratory for not less than 1 year. Enforcement data should be kept for 3 years. This includes all raw data, calculations, quality control data, and reports.

Actual laboratory reports may be kept. However, data, with the exception of compliance check samples as detailed in section 141.33(b) of the National Interim Primary Drinking Water Regulations, may be transferred to tabular summaries. The following information should be included:

- Date, place, and time of sampling; name of person who collected the sample.
- Identification of sample as to whether it is a routine distribution system sample, check sample, raw or process water sample, or other special purpose sample.
- Date of receipt of sample and analysis.
- Laboratory and persons responsible for performing analysis.
- Analytical technique/method used.
- Results of analysis.

FREE CHLORINE RESIDUAL AND TURBIDITY

Free chlorine residual and turbidity measurements do not need to be done in approved laboratories, but may be performed by any persons acceptable to the State. There is, however, a definite need for quality control guidelines to be instituted at the State level for these measurements; it is equally important that systems be in use to assure validity of data for these critical measurements. If the criteria below are met, the States should be able to approve persons performing the measurements.

Free Chlorine Residual

The following are criteria for free chlorine residual measurements:

- *Method:* DPD Colorimetric Method, described on pages 129-132 in "Standard Methods for the Examination of Water and Wastewater," 13th edition.
- *Sample preservation:* None; analyses must be made as soon as practicable, or within 1 hour.
- *Sample container:* Plastic or glass.
- *Equipment:* DPD Colorimetric Test Kit, or spectrophotometer or photometer.

Turbidity

Criteria for measuring turbidity are the following:

- *Method:* Nephelometric, described on pages 350-353 in "Standard Methods for the Examination of Water and Wastewater," 13th edition, and on pages 295-298 in EPA's "Methods for Chemical Analysis of Water and Wastes."
- *Sample preservation:* None; analyses must be made as soon as practicable or within 1 hour.
- *Sample container:* Plastic or glass.
- *Equipment:* Nephelometer
- *Calibration of sealed liquid turbidity standards:* Sealed liquid turbidity standards purchased from the instrument manufacturer must be calibrated against properly prepared and diluted formazin standards at least every 4 months in order to monitor their eventual deterioration. These standards should be replaced when any major change from the previous calibration occurs. Solid turbidity standards composed of plastic, glass, or other materials are not reliable and should not be used.

ACTION RESPONSE TO LABORATORY RESULTS (OPTIONAL REQUIREMENTS)

When action response is a designated laboratory responsibility, the water plant operator and State engineer are promptly notified on unsatisfactory sample results, and a request is made for resampling from the same sampling point.

SAMPLE FORMS FOR ON-SITE EVALUATION OF LABORATORIES INVOLVED IN ANALYSIS OF PUBLIC WATER SUPPLIES

CHEMISTRY (INORGANIC AND ORGANIC)

LABORATORY: _____

STREET: _____

CITY: _____ STATE: _____

TELEPHONE NUMBER: _____

SURVEY BY: _____

AFFILIATION: _____

DATE: _____

PERSONNEL

SAMPLE FORM ONLY

Laboratory _____

Location _____

Date _____

Evaluator _____

Position/title	Name	Academic training			Present specialty	Experience (years/area)
		HS	BA/BS	Other		
Inorganic analyst(s)						
Organic analyst(s)						
Supervisor/consultant						
Laboratory director						

LABORATORY FACILITIES

SAMPLE FORM ONLY

Laboratory_____

Location_____

Date_____

Evaluator_____

Item	Available		Comments
	Yes	No	
Labspace (cite ft^2/person)			
Bench space (linear feet)			
Sink (with hot and cold running water)			
Electrical services			
Distilled water			
Deionized water			
Exhaust hood			

LABORATORY EQUIPMENT AND INSTRUMENTATION SPECIFICATIONS

SAMPLE FORM ONLY

Laboratory _____

Location _____

Date _____

Evaluator _____

Item	Number of units	Make	Model	Age/condition
Analytical balance				
Photometers: Spectrophotometer				
Filter photometer				
pH Meter				
Specific ion meter				
Atomic absorption spectrophotometer				
Gas chromatograph				
Recorders: For atomic absorption				
For gas chromatograph				
Conductivity meter				
Drying oven				
Desiccator				
Hot plate				
Refrigerator				
Glassware				
Water bath				

GENERAL LABORATORY PRACTICES

SAMPLE FORM ONLY

Laboratory _____

Location _____

Date _____

Evaluator _____

Item	Comments (Where applicable, cite system, quality check, adequacy of procedures)
Prepackaged kits	
Calibration intervals	
Glassware preparation	
Distilled deionized water	
Chemicals/reagents	
Laboratory safety equipment	

METHODOLOGY

SAMPLE FORM ONLY

Laboratory _____

Location _____

Date _____

Evaluator _____

Parameter	Name or description of method	Method used (cite page and year)				Number of analyses (frequency)			Satisfactory[1]	
		SM	ASTM	EPA	Other	Daily	Weekly	Monthly	Yes	No
Arsenic										
Barium										
Cadmium										
Chromium										
Lead										
Mercury										
Nitrate										
Selenium										
Silver										
Fluoride										
Chlorinated hydrocarbons: Endrin										
Lindane										
Methoxychlor										
Toxaphene										
Chlorophenoxys 2,4-D										
2,4,5-TP										

[1]For use only by certifying authority.

SAMPLE COLLECTING, HANDLING, AND PRESERVATION

SAMPLE FORM ONLY

Laboratory _____

Location _____

Date _____

Evaluator _____

Parameter	Container used[1]	Preservative used	Normal holding time	Satisfactory[2]	
				Yes	No
Arsenic					
Barium					
Cadmium					
Chromium					
Lead					
Mercury					
Nitrate					
Selenium					
Silver					
Fluoride					
Chlorinated hydrocarbons					
Chlorophenoxys					

[1]P = Plastic, hard or soft; G = Glass, hard or soft.
[2]For use only by certify authority.

QUALITY CONTROL

SAMPLE FORM ONLY

Laboratory _____

Location _____

Date _____

Evaluator _____

Item	Done			Comments (system used)	Satis.[1]	
	Yes	No	Freq.		Yes	No
Minimum requirements: Quality control data available for inspection						
Use of unknown performance sample						
Documented standard curve						
Standard curve checked prior to each sample set						
Verification of standards (every 20 samples)						
Optional requirements: Service contract on balances						
Use of class S weights						
Use of NBS-certified thermometer						
Use of color standards						
Dating of chemicals						
For lab analyzing samples other than its own						
Use of known reference samples						
Use of duplicate samples						
Standard deviation calculations						
Quality control charts or tabulations						

[1] For use only by certifying authority.

DATA HANDLING

SAMPLE FORM ONLY

Laboratory_____

Location_____

Date_____

Evaluator_____

Item	Comments: system(s) used, frequency, etc.
Records kept for 3 years: Actual laboratory reports	
Tabular summary	
Information included: Date	
Place of sampling	
Time of sampling	
Person collecting sample	
Date of receipt of sample	
Date of analysis	
Type of analysis	
Laboratory and person responsible	
Method(s) used	
Results	

Chapter V

MICROBIOLOGY: CRITERIA AND PROCEDURES FOR INTERIM CERTIFICATION OF LABORATORIES INVOLVED IN ANALYSIS OF PUBLIC WATER SUPPLIES

The criteria and procedures described herein, shown in **bold**, are minimum requirements considered essential for laboratories seeking certification for microbiological analysis of public water supplies. The requirements include laboratory equipment and supplies, laboratory practices, methodology, sample collection, and certain quality control measures. The other items, involving personnel, facilities, additional quality control procedures, data reporting, and action response, are optional. For a commercial laboratory to qualify for certification in microbiology, it must process a minimum of 20 potable water samples per month using either the multiple tube procedure or membrane filter test.

Until National Revised Primary Drinking Water Regulations require certification of water supply laboratories, all specifications will be considered as guidelines to be used by certification officials. At that time, minimal requirements will be essential to certification of laboratories involved in analysis of public water supplies.

The minimum requirements must be in compliance, or action must be taken to correct deficiencies prior to certification. A laboratory that exceeds these minimum requirements is encouraged to maintain and improve those higher standards for facilities, equipment, methodology, and quality control, as well as to continue the upgrading of personnel through training efforts to ensure routine production of reliable data.

The required methods of analyses are referenced in "Standard Methods for the Examination of Water and Wastewater," 13th edition; however, some criteria in this document are more specific and permit fewer variations than "Standard Methods."

The guidelines for quality assurance procedures are those in EPA's quality assurance program as cited in the EPA Manual, "Microbiological Methods for Monitoring the Environment" (EMSL EPA Cincinnati). A valuable source of further detail and background information for the laboratory evaluator is available in EPA's "Handbook for Evaluating Water Bacteriological Laboratories" (EPA-670/9-75-006, August 1976).

Minimum requirements are shown throughout in **bold.**

PERSONNEL[1] (OPTIONAL REQUIREMENTS)

Analyst

The analyst performs microbiological tests with minimal supervision in those specialties for which he is qualified by education and/or training and experience.

[1] Exceptions will be made for those persons employed by the laboratory and currently doing the required analyses prior to promulgation of the interim regulations provided that within 2 years after June 24, 1977, they receive a minimum of 2 weeks of additional training in water microbiology.

Preceding page blank

- *Academic training:* Minimum of high school diploma in academic or laboratory-oriented vocational courses.
- *Job training:* Minimum of 30 days on-the-job training plus one week of supplementary training acceptable to the Federal and State regulatory agency or agency responsible for primacy. Personnel should take advantage of courses available to Federal and State regulatory agencies.
- *Supervision:* Supervision by an experienced professional scientist. In the small water plant laboratory consisting of a single analyst, the services of a State-approved outside consultant must be available.

Supervisor/Consultant

The supervisor directs technical personnel in the proper performance of laboratory procedures and the reporting of results. If no technical supervisor is available, a consultant should be available.

- *Academic training:* Minimum of a bachelor's degree in microbiology, biology, chemistry, or a closely related field. Exceptions will be made for employees of laboratories that serve communities with populations of 50,000 or less if they receive at least 2 weeks of additional training in water microbiology from a Federal agency, State agency, or university.
- *Job training:* Technical training in water microbiology for a minimum of 2 weeks from a Federal agency, State agency, or university in the parameter to be tested. Consultant must have 1 year of bench experience, approved by the State, in total coliform analysis. State laboratory expertise would be the most desirable source of outside consultation.
- *Experience:* One year of bench experience in sanitary (water, milk, or food) microbiology.

LABORATORY FACILITIES (OPTIONAL REQUIREMENTS)

Laboratory space should be adequate (200 ft^2 and 6 linear ft of bench space per analyst) to accommodate periods of peak work load. Working space requirements should include sufficient bench-top area for processing samples; storage space for media, glassware, and portable equipment items; floor space for stationary equipment (incubators, waterbaths, refrigerators, etc.); and associated area for cleaning glassware and sterilizing materials. The space required for both laboratory work and materials preparation in small water plant laboratories may be consolidated into one room, with the various functions allocated to different parts of the room.

Facilities should be clean, air-conditioned, and with adequate lighting at bench top (100 ft-candles).

Laboratory safety, which must be an integral and conscious effort in laboratory operations, should provide safeguards to avoid electric shock, prevent fire, prevent accidental chemical spills, and minimize microbiological dangers, facility deficiencies, and equipment failures. While safety is not an aspect of laboratory certification, the evaluation should point out on an informal basis, potential safety problems observed during an on-site visit.

LABORATORY EQUIPMENT, SUPPLIES, AND MATERIALS (MINIMUM REQUIREMENTS)

The laboratory must have available or access to the items required for the total coliform membrane filter or most probable number procedures as listed below.

- ***pH Meter:*** **Accuracy must be ±0.1 units.**
- ***Balances–top loader or pan:*** **Balance must be clean, not corroded, and be provided with appropriate weights of good quality. Balance must tare out and detect 50-mg weight accurately: this sensitivity is required for use in general media preparation of 2g or larger quantities.**
- ***Temperature-monitoring devices:***

  –Glass or metal thermometers must be graduated in 0.5°C increments.
  –Continuous temperature recording devices must be sensitive to within 0.5°C.
  –Liquid column of glass thermometers must have no separation.
  –A certified thermometer or one of equivalent accuracy must be available.

- ***Air (or water jacketed) incubator/incubator rooms/waterbaths/aluminum block incubators:***

  –Unit must maintain internal temperature of 35.0° ± 0.5°C in area of use at maximum loading.
  –When aluminum block incubators are used, culture dishes and tubes must be snug-fitting in block.

- ***Autoclave:***

  –Autoclave must be in good operating condition when observed during operational cycle or when time-temperature charts are read. Vertical autoclaves are not recommended. For most efficient operation, a double-walled autoclave constructed of stainless steel is suggested (optional).
  –Autoclave must have pressure and temperature gauges on exhaust side and an operating safety valve.
  –Autoclave must reach sterilization temperature (121°C) and be maintained during sterilization cycle: no more than 45 minutes is required for a complete cycle.
  –Depressurization must not produce air bubbles in fermentation media.

- ***Hot-air oven:*** **Oven must be constructed to ensure a stable sterilization temperature.** Its use is optional for sterilization of glass pipets, bottles, flasks, culture dishes, etc. (optional).
- ***Refrigerator:*** **Refrigerator must hold temperature at 1° to 4.4°C (34° to 40°F).**
- ***Optical/counting/lighting equipment:*** **Low power magnification device (preferably binocular microscope with 10 to 15x) with fluorescent light source must be available for counting MF colonies.** A mechanical hand tally can be used for counting colonies (optional).
- ***Inoculation equipment:***

  –Loop diameter must be at least 3 mm and of 22 to 24 gauge Nichrome, chromel, or

platinum-iridium wire. Single-service metal loops, disposable dry heat-sterilized hardwood applicator sticks, pre-sterilized plastic, or metal loops may be used (optional).

- *Membrane filtration equipment:*

  –Units must be made of stainless steel, glass, or autoclavable plastic. Equipment must not leak and must be uncorroded.
  –Field equipment is acceptable for coliform detection only when standard laboratory MF procedures are followed.

- *Membrane filters and pads:*

  –Membrane filters must be manufactured from cellulose ester materials, white, grid-marked, 47-mm diameter, 0.45 μm pore size. Another pore size may be used if the manufacturer gives performance data equal to or better than the 0.45-μm membrane filter.
  –Membranes and pads must be autoclavable or presterilized.

- *Laboratory glassware, plastic ware, and metal utensils:*

  –Except for disposable plastic ware, items must be resistant to effects of corrosion, high temperature, and vigorous cleaning operations. Metal utensils made of stainless steel are preferred (optional).
  –Flasks, beakers, pipets, dilution bottles, culture dishes, culture tubes, and other glassware must be of borosilicate glass and free of chips, cracks, or excessive etching. Volumetric glassware should be Class A, denoting that it meets Federal specifications and need not be calibrated before use.
  –Plastic items must be of clear, inert, nontoxic material and must retain accurate calibration marks after repeated autoclaving.

- *Culture dishes:*

  –Sterile tight or loose-lid plastic culture dishes or loose-lid glass culture dishes must be used.
  –For loose-lid culture dishes, relative humidity in the incubator must be at least 90 percent.
  –Culture dish containers must be aluminum or stainless steel; or dishes may be wrapped in heavy aluminum foil or char-resistant paper.
  –Open packs of disposable sterile culture dishes must be resealed between uses.

- *Culture tubes and closures:*

  –Culture tubes must be made of borosilicate glass or other corrosion resistant glass and must be of a sufficient size to contain the culture medium, as well as the sample portions employed, without being more than 3/4 full. It is desirable that the fermentation vial extend above the medium (optional).
  –Caps must be snug-fitting stainless steel or plastic; loose-fitting aluminum caps or screw caps are also acceptable.

- *Measuring equipment:*

  –Sterile, glass or plastic pipets must be used for measuring 10 ml or less.
  –Pipets must deliver the required volume quickly and accurately within a 2.5 percent tolerance.
  –Pipets must not be badly etched; mouthpiece or delivery tips must not be chipped; graduation marks must be legible.
  –Open packs of disposable sterile pipets must be resealed between uses.
  –Pipet containers must be aluminum or stainless steel.
  –Graduated cylinders must be used for samples larger than 10 ml; calibrated membrane filter funnel markings are permissible provided accuracy is within a 2.5 percent tolerance.

GENERAL LABORATORY PRACTICES (MINIMUM REQUIREMENTS)

Sterilization Procedures

- The following times and temperatures must be used for autoclaving materials:

Material	*Temperature/Minimum Time*
Membrane filters and pads	121°C/10 min.
Carbohydrate-containing media (lauryl tryptose, brilliant green lactose bile broth, etc.)	121°C/12-15 min.
Contaminated materials and discarded tests	121°C/30 min.
Membrane filter assemblies (wrapped), sample collection bottles (empty), individual glassware items	121°C/30 min.
Rinse water volumes of 500 ml to 1,000 ml	121°C/45 min.
Rinse water in excess of 1,000 ml	121°C/time adjusted for volume; check for sterility
Dilution water blank	121°C/30 min.

Membrane filter assembles must be sterilized between sample filtration series. A filtration series ends when 30 minutes or longer elapse between sample filtrations. At least 2 minutes of UV light or boiling water may be used on membrane filter assembly to prevent bacterial carry-over between filtrations (optional).

Dried glassware must be sterilized at a minimum of 170°C for 2 hours.

Laboratory Pure Water (Distilled, Deionized, or Other Processed Waters)

- An analyst must test the quality of the laboratory pure water or have it tested by the State or by a State-authorized laboratory.

- **Only water determined as laboratory pure water (see quality control section) can be used for performing bacteriological analyses.**

Although processed water may be acceptable for routine chemistry, there is a good chance that it contains enough of some constituent to be toxic or stimulatory to microorganisms (optional).

Rinse and Dilution Water

Stock buffer solution must be prepared according to "Standard Methods" using laboratory pure water adjusted to pH 7.2. Stock buffer must be autoclaved or filter-sterilized, labeled, dated, and stored at 1° to 4.4°C. The stored buffer solution must be free of turbidity.

Rinse and dilution water must be prepared by adding 1.25 ml of stock buffer solution per liter of laboratory pure water. Final pH must be 7.2 ± 0.1.

Media Preparation and Storage

The following are minimum requirements for storing and preparing media:

- Laboratories must use commercial dehydrated media for routine bacteriological procedures as quality control measures.
- Lauryl tryptose and brilliant green lactose bile broths must be prepared according to "Standard Methods"; lactose broth is not permitted.
- Dehydrated media containers must be kept tightly closed and stored in a cool, dry location. Discolored or caked dehydrated media cannot be used.
- Laboratory pure water must be used; dissolution of the media must be completed before dispensing to culture tubes or bottles.
- The membrane filter broth and agar media must be heated in a boiling water bath until completely dissolved.
- Membrane filter (MF) broths must be stored and refrigerated no longer than 96 hours. MF agar media must be stored, refrigerated and used within 2 weeks.
- Most probable number (MPN) media prepared in tubes with loose-fitting caps must be used within 1 week. If MPN media are refrigerated after sterilization, they must be incubated overnight at 35°C to confirm usability. Tubes showing growth or gas bubbles must be discarded.
- Media in screw cap containers may be held up to 3 months, provided the media are stored in the dark and evaporation is not excessive (0.5 ml per 10 ml total volume). Commercially prepared liquid and agar media supplies may be used (optional).
- Ampouled media must be stored at 1° to 4.4°C (34° to 40°F); time must be limited to manufacturer's expiration date.

METHODOLOGY (MINIMUM REQUIREMENTS)

The required procedures, which are mandatory, are described in the 13th edition of "Standard Methods": standard coliform MPN tests (p. 664-668), single step or enrichment standard total coliform membrane filter procedure (p. 679-683). Tentative methods are not acceptable. All other procedures are considered alternative analytical techniques as described in section 141.27

of the National Interim Primary Drinking Water Regulations. Application for the use of alternative methods may require acceptable comparability data.

The membrane filter procedure is preferred because it permits analysis of large sample volumes in reduced analysis time. The membranes should show good colony development over the entire surface. The golden green metallic sheen colonies should be counted and recorded as the coliform density per 100 ml of water sample. The following rules for reporting any problem with MF results must be observed:

- *Confluent growth:* Growth (with or without discrete sheen colonies) covering the entire filtration area of the membrane. Results are reported as "confluent growth per 100 ml, with (or without) coliforms," and a new-sample requested.
- *TNTC (Too numerous to count):* The total number of bacterial colonies on the membrane is too numerous (usually greater than 200 total colonies), not sufficiently distinct, or both. An accurate count cannot be made. Results are reported as "TNTC per 100 ml, with (or without) coliforms," and a new sample requested.
- *Confluent growth and TNTC:* A new sample must be requested, and the sample volumes filtered must be adjusted to apply the MF procedure; otherwise the MPN procedure must be used.
- *Confirmed MPN test on problem supplies:* If the laboratory has elected to use the MPN test on water supplies that have a continued history of confluent growth or TNTC with the MF procedure, all presumptive tubes with heavy growth without gas production should be submitted to the confirmed MPN test to check for the suppression of coliforms. A count is adjusted based upon confirmation and a new sample requested. This procedure should be carried out on one sample from each problem water supply once every 3 months.

SAMPLE COLLECTION, HANDLING, AND PRESERVATION (MINIMUM REQUIREMENTS)

When the laboratory has been delegated responsibility for sample collecting, handling, and preservation, there must be strict adherence to correct sampling procedures, complete identification of the sample, and prompt transfer of the sample to the laboratory as described in "Standard Methods," 13th edition, section 450, p. 657-660.

The sample must be representative of the potable water system. The sampling program must include examination of the finished water at selected sites that systematically cover the distribution network.

Minimum sample frequency must be that specified in the National Interim Primary Drinking Water Regulations, 40 CFR 141.21.

The collector must be trained in sampling procedures and approved by the State regulatory authority or its delegated representative.

The water tap must be sampled after maintaining a steady flow for 2 or 3 minutes to clear service line. The tap is free of aerator, strainer, hose attachment, or water purification devices.

The sample volume must be a minimum of 100 ml. The sample bottle must be filled only to the shoulder to provide space for mixing.

The sample report form must be completed immediately after collection with location, date and time of collection, chlorine residual, collector's name, and remarks.

Sample bottles must be of at least 120 ml-capacity, sterile plastic or hard glass, wide mouthed with stopper or plastic screw cap, and capable of withstanding repeated sterilization. Sodium thiosulfate (100 mg/l) is added to all sample bottles during preparation. As an example, 0.1 ml of a 10 percent solution is required in a 4-oz (120-ml) bottle.

Date and time of sample arrival must be added to the sample report form when sample is received in the laboratory.

State regulations relating to chain-of-custody, if required, must be followed in the field and in the laboratory.

Samples delivered by collectors to the laboratory must be analyzed on the day of collection.

Where it is necessary to send water samples by mail, bus, United Parcel Service, courier service, or private shipping, holding/transit time between sampling and analyses must not exceed 30 hours. When possible, samples are refrigerated during transit and during storage in the laboratory (optional).

If the laboratory is required by State regulation to examine samples after 30 hours and up to 48 hours, the laboratory must indicate that the data may be invalid because of excessive delay before sample processing. Samples arriving after 48 hours shall be refused without exception and a new sample requested. (The problem of holding time is under investigation by EPA.)

QUALITY CONTROL PROGRAM

Minimum Requirement

A written description for current laboratory quality control program must be available for review. Management, supervisors, and analysts participate in setting up the quality control program. Each participant should have a copy of the quality control program and a detailed guide of his own portion. A record on analytical quality control tests and quality control checks on media, materials, and equipment must be prepared and retained for 3 years.

Analytical Quality Control Tests for General Laboratory Practices and Methodology

Minimum and optional requirements for analytical quality control tests for general practices and methodology are:

- *Minimum requirements:*
  - At least five sheen or borderline sheen colonies must be verified from each membrane containing five or more such colonies. Counts must be adjusted based on verification. The verification procedure must be conducted by transferring growth from colonies into lauryl tryptose broth (LTB) tubes and then transferring growth from gas-positive LTB cultures to brilliant green lactose bile (BGLB) tubes. Colonies must not be transferred exclusively to BGLB because of the lower recovery of stressed coliforms in this more selective medium. However, colonies may be transferred to LTB and BGLB simultaneously. Negative LTB tubes must be reincubated a second day and confirmed if gas is produced. It is desirable to verify all sheen and borderline sheen colonies (optional).
  - A start and finish MF control test (rinse water, medium, and supplies) must be conducted for each filtration series. If sterile controls indicate contamination, all data on samples affected must be rejected and a request made for immediate resampling of those waters involved in the laboratory error.

- **–The MPN test must be carried to completion, except for gram staining, on 10 percent of positive confirmed samples. If no positive tubes result from potable water samples, the completed test except for gram staining must be performed quarterly on at least one positive source water.**
- **–Laboratory pure water must be analyzed annually by the test for bactericidal properties for distilled water ("Standard Methods," 13th edition, p. 646). Only satisfactorily tested water is permissible in preparing media, reagents, rinse, and dilution water. If the tests do not meet the requirements, corrective action must be taken and the water retested.**
- **–Laboratory pure water must be analyzed monthly for conductance, pH, chlorine residual, and standard plate count. If tests exceed requirements, corrective action must be taken and the water retested.**
- **–Laboratory pure water must not be in contact with heavy metals. It must be analyzed initially and annually thereafter for trace metals (especially Pb, Cd, Cr, Cu, Ni, and Zn). If tests do not meet the requirements, corrective action must be taken and the water retested.**
- **–Standard plate count procedure must be performed as described in "Standard Methods," 13th edition, p. 660-662. Plates must be incubated at 35° ± 0.5°C for 48 hours.**
- **–Requirements for laboratory pure water:**

pH	**5.5 - 7.5**
Conductivity	**Greater than 0.2 megohm as resistivity or less than 5.0 micromhos/cm at 25°C**
Trace metals:	
A single metal	**Not greater than 0.05 mg/l**
Total metals	**Equal to or less than 1.0 mg/l**
Test for bactericidal properties of distilled water ("Standard Methods," 13th edition, p. 646)	**0.8 - 3.0**
Free chlorine residual	**0.0**
Standard plate count	**Less than 10,000/ml**

- **–Laboratory must analyze one quality control sample per year (when available) for parameter(s) measured.**
- **–Laboratory must satisfactorily analyze one unknown performance sample per year (when available) for parameter(s) measured.**

- *Optional requirements:*

- –Duplicate analyses should be run on known positive samples at a minimum frequency of one per month. The duplicates may be run as a split sample by more than one analyst, with each split being a 50-ml sample.
- –Water plant laboratories should examine a minimum of one polluted water source per month in addition to the required number of distribution samples.
- –If there is more than one analyst in laboratory, at least once per month each analyst

should count the sheen colonies on a membrane from a polluted water source. Colonies on the membrane should be verified and the analysts' counts compared to the verified count.

–A minimum number of the official water supply samples required for each system should be analyzed by the State laboratory. For example, systems that are required to have less than 10 samples examined per month should submit one additional sample to a State authorized laboratory. Water systems with sample requirements above 10 per month would submit two additional samples to a State authorized laboratory.

Quality Control Checks of Laboratory Media, Equipment, and Supplies

Minimum and optional requirements for quality control checks of laboratory media, equipment, and supplies are:

- *Minimum requirements:*

  –pH meter must be clean and calibrated each use period with pH 7.0 standard buffer. Buffer aliquot must be used only once. Commercial buffer solutions must be dated on initial use.

  –Balances (top loader or pan) must be calibrated annually.

  –Glass thermometers or continuous recording devices for incubators must be checked yearly and metal thermometers quarterly (or at more frequent intervals when necessary) against a certified thermometer or one of equivalent accuracy.

  –Temperature in air (or water jacketed) incubator/incubator room/waterbaths/aluminum block incubators must be recorded continuously or recorded daily from in-place thermometer(s) immersed in liquid and placed on shelves in use.

  –Date, time, and temperature must be recorded continuously or recorded for each sterilization cycle of the autoclave.

  –Hot air oven must be equipped with a thermometer calibrated in the range of 170°C or with a temperature recording device. Records must be maintained showing date, time, and temperature of each sterilization cycle. It is desirable to place the thermometer bulb in sand and to avoid overcrowding (optional).

  –Membrane filters used must be those recommended by the manufacturer for water analysis. The recommendation must be based on data relating to ink toxicity, recovery, retention, and absence of growth-promoting substances.

  –Washing processes must provide clean glassware with no stains or spotting. With initial use of a detergent or washing product and whenever a different washing product is used, the rinsing process must demonstrate that it provides glassware free of toxic material by the inhibitory residue test ("Standard Methods," 13th edition, p. 643).

  –At least one bottle per batch of sterilized sample bottles must be checked by adding approximately 25 ml of sterile LTB broth to each bottle. It must be incubated at 35 ± 0.5°C for 24 hours and checked for growth.

  –Service contracts or approved internal protocols must be maintained on balances, autoclave, water still, etc., and the service records entered in a log book.

–**Records must be available for inspection on batches of sterilized media showing lot numbers, date, sterilization time-temperature, final pH, and technician's name.**

- *Optional requirements:*

–Positive and negative cultures should be used, and testing should be carried out to determine recovery and performance compared to a previous acceptable lot of medium.

–Media should be ordered on a basis of 12-month needs. Bottles should be dated on receipt and when opened initially. Except for large volume uses, media should be purchased in 1/4-lb bottles. Bottles of media should be used within 6 months after opening; however, in no case should opened media be used after one year. Opened bottles should be stored in a desiccator to extend storage time beyond 6 months. Shelf life of unopened bottles is 2 years.

–Testing should be carried out in media and membranes to determine recovery and performance compared to previous acceptable lot.

–Lot number of membrane filters and date of receipt should be recorded.

–Heat sensitive tapes and spore strips or ampoules should be used during sterilization. Maximum registering thermometer is recommended.

DATA REPORTING (MINIMUM REQUIREMENTS)

Where the laboratory has the responsibility for sample collections, the sample collector should complete a sample report form immediately after each sample is taken. The information on the form includes sample identification number, sample collector's name, time and date of collection, arrival time and date in the laboratory, direct count, MF verified count, MPN completed count, analyst's name, and other special information.

Results should be calculated and entered on the sample report form to be forwarded. A careful check should be made to verify that each result was entered correctly from the bench sheet and initialed by the analyst.

All results should be reported immediately to the proper authority.

Positive results are reported as preliminary without waiting for MF verification or MPN completion. After MF verification and/or MPN completion, the adjusted counts should be reported.

A copy of the sample report form should be retained either by the laboratory or State program for 3 years. If results are entered into a computer storage system, a printout of the data should be returned to the laboratory for verification with bench sheets.

ACTION RESPONSE TO LABORATORY RESULTS (MINIMUM REQUIREMENT)

When action response is a designated laboratory responsibility, the proper authorities should be promptly notified on unsatisfactory sample results, and a request should be made for resampling from the same sampling point.

SAMPLE FORMS FOR ON-SITE EVALUATION OF LABORATORIES INVOLVED IN ANALYSIS OF PUBLIC WATER SUPPLIES–MICROBIOLOGY

LABORATORY: _____

STREET: _____

CITY: _____ STATE: _____

TELEPHONE NUMBER: _____

SURVEY BY: _____

AFFILIATION: _____

DATE: _____

CODES FOR MARKING ON-SITE EVALUATION FORMS:

S–Satisfactory
U–Unsatisfactory
NA–Not Applicable

Laboratory _____ Evaluator _____

Location _____ Date _____

PERSONNEL

The form dealing with personnel can be found on page 52.

LABORATORY FACILITIES

Space in laboratory and preparation room is adequate for needs during peak work periods (200 ft^2 and 6 linear ft of usable bench space per analyst).

Facilities are clean, with adequate lighting (100 ft-candles) and air conditioning.

NOTE: Material on pages 53-85, except where indicated, are minimum requirements.

PERSONNEL

Laboratory _____

Location _____

Date _____

Evaluator _____

Position/title	Name	Academic training				Present specialty	Experience (years/area)
		HS	BA/BS	MA/MS	Ph.D.		
Laboratory director							
Supervisor/consultant							
Professionals (note discipline)							
Technician/analyst							

SAMPLE FORM ONLY

Laboratory _____ Evaluator _____

Location _____ Date _____

LABORATORY EQUIPMENT, SUPPLIES, AND MATERIALS

1. pH Meter

Manufacturer _____ Model _____

Clean, calibrated to 0.1 pH units each use period; record maintained ..... ____
Aliquot of standard pH 7.0 buffer used only once ..... ____

2. Balance–Top Loader or Pan

Manufacturer _____ Model _____

Clean. Detects a 50-mg weight accurately (for a general media preparation of ≥2-g quantities) ..... ____
Good quality weights in clean condition ..... ____

3. Temperature-Monitoring Devices

Accuracy checked annually against a certified thermometer or one of equivalent accuracy ..... ____
Legible graduations in 0.5°C-increments ..... ____
No separation in liquid column ..... ____

4. Incubator or Incubator Room

Manufacturer _____ Model _____

Sufficient size for daily work load ..... ____
Uniform temperature maintained on shelves in all areas used (35.0° ± 0.5°C) ..... ____
Calibrated thermometer with bulb immersed in liquid and located on shelves in use.. ____
Temperature recorded daily or recording thermometer sensitive to ± 0.5°C ..... ____

5. Autoclave

Manufacturer _____ Model _____

Reaches sterilization temperature (121°C), maintains 121°C during sterilization cycle, and requires no more than 45 min for a complete cycle..... ____
Pressure and temperature gauges on exhaust side and an operating safety valve ..... ____
No air bubbles produced in fermentation vials during depressurization..... ____
Record maintained on time and temperature for each sterilization cycle ..... ____

6. Hot-Air Oven

Manufacturer _____ Model _____

Operates at a minimum of 170°C ..... ____
Thermometer inserted or oven equipped with temperature-recording thermometer device ..... ____
Time and temperature record maintained for each sterilization cycle ..... ____
Thermometer bulb in sand (optional)

7. Refrigerator

Temperature maintained at 1° to 4.4°C (34° to 40°F) ..... ____

8. Optical Equipment

Low power magnification device (preferably binocular microscope with 10 to 15X) with fluorescent light source for counting MF colonies ..... ____
Colonies counted with a mechanical hand tally (optional)

9. Inoculation Equipment

Sterilized loops of at least 3-mm diameter, 22 to 24 gauge Nichrome, Chromel, or platinum-iridium wire ..... ____

or

Disposable dry heat-sterilized hardwood applicator sticks or presterilized loops ..... ____

10. Membrane Filtration Equipment

Manufacturer _____ Model _____

Made of stainless steel, glass, or autoclavable plastic ..... ____
Nonleaking and uncorroded ..... ____

11. Membrane Filters and Pads

Manufacturer _____ Model _____

Filters recommended by manufacturer for water analyses ..... ____
Filters and pads presterilized or autoclavable ..... ____

12. Glass, Plastic, and Metal Utensils for Media Preparation

Washing process provides glassware free of toxic residue as demonstrated by the inhibitory residue test ..... ____
Glass items of borosilicate, free of chips and cracks ..... ____
Utensils clean and free from foreign residues or dried medium ..... ____
Plastic items clear with visible graduations ..... ____

13. Sample Bottles

Wide-mouth hard glass bottles; stoppered or plastic screw-capped; capacity at least 120 ml ..... ____
Glass-stoppered bottles with tops covered with aluminum foil or kraft paper ..... ____
Screw-caps have leakproof nontoxic liners that can withstand repeated sterilization (30 min at 121°C) ..... ____
Sterile sample bottles contain 10 mg of dechlorinating agent per 100 ml of sample .. ____

14. Pipets

Brand _____ Type _____

Sterile; glass or plastic; with a 2.5 percent tolerance ..... ____
Tips unbroken; graduations distinctly marked..... ____

15. Pipet Containers

Aluminum, stainless steel ..... ____
Pipets wrapped in quality kraft paper (char-resistant) ..... ____
Open packs of disposable sterile pipets resealed between uses..... ____

16. Culture Dishes

Brand _____ Type _____

Sterile plastic or glass ..... ____
Open packs of disposable sterile plastic dishes resealed between uses ..... ____
Dishes are in containers of aluminum or stainless-steel with covers or are wrapped with heavy aluminum foil or char-resistant paper..... ____

17. Culture Tubes and Closures

Sufficient size to contain sterile medium and sample without danger of spillage..... ____
Metal or plastic caps; plastic plugs..... ____
Borosilicate glass or other corrosion-resistant glass ..... ____

Laboratory _____ Evaluator _____

Location _____ Date _____

GENERAL LABORATORY PRACTICES

1. Sterilization Procedures

Satisfactory sterilization procedures and/or records ..... ____
Tube broth media and reagents sterilized at 121°C 12 to 15 min ..... ____
Tubes and flasks packed loosely in baskets or racks for uniform heating and cooling . ____
MF presterilized or autoclaved at 121°C for 10 min with fast exhaust ..... ____
MF assemblies and empty sample bottles sterilized at 121°C for 30 min..... ____
MF assemblies sterilized between sample filtration series ..... ____
Rinse water volumes of 500 to 1,000 ml sterilized at 121°C
for 45 min ..... ____
Dilution water blanks autoclaved at 121°C for 30 min ..... ____
Wire loops, needles, and forceps sterilized..... ____
Total exposure of MPN media to heat not over 45 min..... ____
Timing for sterilization begins when autoclave reaches 121°C..... ____
Individual glassware items autoclaved at 121°C for 30 min..... ____
Individual dry glassware items sterilized 2 hours at 170°C (dry heat) ..... ____
Pipets, culture dishes, and inoculating loops in boxes sterilized at 170°C for 2 hours . ____
MPN media removed and cooled as soon as possible after sterilization and stored in cool dark place (optional)
UV light or boiling water for at least 2 min may be used on membrane filter assemblies to reduce bacterial carry-over between each filtration (optional)

2. Laboratory Pure Water

Only laboratory pure water used in preparing media, reagents, rinse water, and dilution water..... ____
Laboratory pure water not in contact with heavy metals ..... ____

Source: Laboratory-prepared _____ Purchased _____

If laboratory-prepared:
Still manufacturer _____
Deionizer manufacturer _____
Record of recharge frequency _____

Production rate and quality adequate for laboratory needs..... ____
Inspected, repaired, cleaned by service contract or in-house service ..... ____

a. Chemical quality control

Record of satisfactory annual analyses for trace metals
A single metal not greater than 0.05 mg/l ..... ____

Total metals: equal to or less than 1.0 mg/l. . . . . ____

Record of monthly analyses of laboratory pure water

Conductance: >0.2 megohm resistivity or <5.0 microhmos/cm . . . . . ____
pH: 5.5-7.5 . . . . . ____
Standard plate count: <10,000/ml. . . . . ____
Free chlorine residual: 0.0 . . . . . ____

b. Microbiological quality control

Test for bactericidal properties of distilled water (0.8-3.0) performed at least annually . . . . . ____

Testing laboratory _____ Date _____ Ratio _____

3. Rinse and Dilution Water

Stock buffer solution prepared according to "Standard Methods," 13th edition. . . . . ____
Stock buffer solution adjusted to pH 7.2 . . . . . ____
Stock buffer autoclaved at 121°C, stored at 1° to 4.4°C (34° to 40°F) or filter sterilized. . . . . ____
Stock buffer labeled and dated . . . . . ____
Stock potassium phosphate buffer solution (1.25 ml) added per liter distilled water for rinse and dilution water . . . . . ____
Final pH 7.2 ± 0.1. . . . . ____

4. Media

Dehydrated media bottle kept tightly closed and protected from dust and excessive humidity in storage areas . . . . . ____
Dehydrated media not used if discolored or caked . . . . . ____
Laboratory pure water used in media preparation. . . . . ____
Dissolution of media complete before dispensing to culture tubes or bottles . . . . . ____
MPN tube media with loose-fitting caps used in less than 1 week . . . . . ____
Tube media in screw-capped tubes held no longer than 3 months. . . . . ____
Ampouled media stored at 1° to 4.4°C and time limited to manufacturer's expiration date. . . . . ____
Media stored at low temperatures are incubated overnight prior to use and tubes with air bubbles discarded . . . . . ____
Media protected from sunlight . . . . . ____
MF media stored in refrigerator; broth medium used within 96 hours, agar within two weeks if prepared in tight-fitting dishes. . . . . ____

5. Lauryl Tryptose Broth

Manufacturer _____ Lot No. _____

Single strength composition, 35.6 g per liter pure water ..... ____
Single strength pH 6.8 ± 0.2; double strength pH 6.7 ± 0.2 ..... ____
Not less than 10 ml per tube ..... ____
Media made to result in single strength after addition of sample portions ..... ____

6. Brilliant Green Lactose Bile Broth

Manufacturer _____ Lot No. _____

Medium composition 40 g per liter pure water ..... ____
Final pH 7.2 ± 0.2 ..... ____

7. M-Endo Media

Manufacturer _____ Lot No. _____

Medium composition 48.0 g per liter pure water optionally 15 g agar added/l ..... ____
Reconstituted in laboratory pure water containing 2 percent ethanol (not denatured) ..... ____
Final pH 7.2 ± 0.2 ..... ____
Medium held in boiling water bath until completely dissolved ..... ____

8. Standard Plate Count Agar

Correct composition, sterile and pH 7.0 ± 0.2 ..... ____
Sterile medium not remelted a second time after sterilization ..... ____
Culture dishes incubated 48 hours at 35° ± 0.5°C ..... ____
No more than 1.0 ml or less than 0.1 ml sample plated (sample or dilution) ..... ____
Liquefied agar, 10 ml or more; medium temperature between 44° to 46°C ..... ____
Melted medium stored no longer than 3 hours before use ..... ____
Only plates with between 30 to 300 colonies counted; when 1 ml of undiluted sample is plated, colony density may be less than 30 ..... ____
Only two significant figures recorded and calculated as standard plate count/1.0 ml ..... ____

Laboratory _____ Evaluator _____

Location _____ Date _____

METHODOLOGY

Methodology specified in "Standard Methods," 13th edition, or EPA manual ..... ____
M-Endo broth, M-Endo agar, or Les Endo agar used in a single step procedure ..... ____
In two-step Les M-Endo procedure, MF incubated on lauryl-tryptose-broth-saturated absorbent pad for 1.5 to 2 hours at 3.5° ± 0.5°C; then on M-Endo broth or Les Endo agar for 20 to 22 hours at 35° ± 0.5°C ..... ____

1. Total Coliform Membrane Filter Procedure

Samples containing excessive bacterial populations (greater than 200), confluency, or turbidity retested by the MPN procedure. ..... ____
Filtration assembly sterile at start of each series ..... ____
Absorbent pads saturated with medium, excess discarded; or 4.0 ml of agar medium can be used per culture dish instead of a pad ..... ____
Sample shaken vigorously immediately before test ..... ____
Test sample portions measured and not less than 100 ml ..... ____
Funnel rinsed at least twice with 20- to 30-ml portions of sterile buffered water .... ____
MF removed with sterile forceps grasping ~~area~~ outside effective filtering area. ..... ____
MF rolled onto medium pad or agar so air bubbles are not trapped. ..... ____

2. Incubation of Membrane Filter Cultures

Total incubation time 22 to 24 hours at 35° ± 0.5°C ..... ____
Incubated in tight-fitting culture dishes or loose-fitting dishes incubated in high relative humidity chambers ..... ____

3. Membrane Filter Colony Counting

Samples repeated when coliforms are "TNTC" or colony growth is confluent, possibly obscuring coliform development and/or detection ..... ____
Total coliform count calculated in density per 100 ml ..... ____
Samples containing five or more coliforms per 100 ml are resampled and tested .... ____
Low power magnification device with fluorescent light positioned for maximum sheen visibility ..... ____

4. Verification of Total Coliform Colonies

All typical coliform (sheen) colonies or at least five randomly selected sheen colonies verified in lauryl tryptose broth and BGLB. ..... ____
Counts adjusted based on verification ..... ____
All atypical coliform (borderline sheen) colonies or at least five randomly-selected colonies verified in LTB and BGLB ..... ____
Counts adjusted based on verification ..... ____

5. MF Field Equipment

Manufacturer _____ Model _____

Only standard laboratory MF procedures adapted to field application ..... ____

6. Total Coliform Most Probable Number Procedure

a. Presumptive Test

Five standard portions, either 10 or 100 ml ..... ____
Sample shaken vigorously immediately before test ..... ____
Tubes incubated at 35° ± 0.5°C for 24 ± 2 hours ..... ____
Examined for gas (any gas bubble indicates positive test) ..... ____
Tubes that are gas-positive within 24 hours submitted promptly to confirm test . ____
Negative tubes returned to incubator and examined for gas within 48 ± 3 hours; positives submitted to confirm test ..... ____
Public water supply samples with heavy growth and no gas production confirmed for presence of suppressed coliforms..... ____
Adjusted count reported based upon confirmation..... ____
Adequate test labeling and tube dilution coding (optional)

b. Confirmed Test

Presumptive positive tube gently shaken or mixed by rotating ..... ____
One loopful or one dip of applicator transferred from presumptive tube to BGLB..... ____
Incubated at 35°C ± 0.5°; checked within 24 hours ± 2 hours for gas production. ____
Positive confirmed tube results recorded; negative tubes reincubated and read within 48 ± 3 hours ..... ____
Unsatisfactory sample defined as three or more positive confirmed tubes..... ____

c. Completed Test

Applied to 10 percent of all positive samples each quarter ..... ____
Applied to all positive confirmed tubes in each test completed..... ____
Positive confirmed tubes streaked on EMB plates for colony isolation ..... ____
Plates adequately streaked to obtain discrete colonies..... ____
Incubated at 35° ± 0.5°C for 24 ± 2 hours ..... ____
Typical nucleated colonies, with or without sheen, on EMB plates selected for completed test identification ..... ____
If typical colonies absent, atypical colonies selected for completed test identification ..... ____
If no colonies or only colorless colonies appear, confirmed test for that particular tube considered negative..... ____
An isolated typical colony or two atypical colonies transferred to lauryl tryptose broth ..... ____
Incubated at 35° ± 0.5°C; checked for gas within 48 ± 3 hours..... ____
Cultures producing gas in lauryl tryptose broth within 48 ± 3 hours are considered coliforms ..... ____

Laboratory _____ Evaluator _____

Location _____ Date _____

SAMPLE COLLECTION, HANDLING, AND PRESERVATION

Representative samples of potable water distribution system ..... ____
Minimal sampling frequency as specified in the National Interim Primary Drinking Water Regulations ..... ____
Sample collector trained and approved as required by State regulatory authority or its delegated representative ..... ____

1. Sample Bottles

Sterile sample bottles of at least 120 ml; able to withstand repeated sterilization .... ____
Ample air space remains after sample collected to allow for adequate mixing..... ____
Sodium thiosulfate, 100 mg/l, added to sample bottle before sterilization ..... ____

2. Sampling

Sample collected after maintaining a steady flow for 2 to 3 min to clear service line..... ____
Tap free of aerator, strainer, hose attachment, water purification, or other devices .. ____
Samples refrigerated when possible during transit and storage periods in the laboratory (optional)

3. Sample Identification

Sample identified immediately after collection ..... ____
Identification includes, water source, location, time and date of collection, and collector's name; insufficiently identified samples discarded..... ____
Chlorine residual where applicable ..... ____

4. Sample Transit Time

Transit time for potable water samples sent by mail or commercial transportation, not in excess of 30 hours ..... ____
No sample processed after 48-hour transit/storage ..... ____
Samples delivered to laboratory by collectors examined the day of collection ..... ____
Data marked as questionable on samples analyzed after 30 hours..... ____

5. Sample Receipt in Laboratory

Sample logged in when received in laboratory, including date and time of arrival and analysis..... ____
Chain-of-custody procedures required by State regulations followed ..... ____

Laboratory _____ Evaluator _____

Location _____ Date _____

QUALITY CONTROL

A written laboratory quality control program is available for review. . . . . ____

1. Analytical Quality Control

A record containing results of analytical control tests available for review . . . . . ____

a. Verification of MF Colonies

At least five coliforms verified from each positive sample . . . . . ____
Sheen colonies in mixed confluent growth reported and verified (optional)

b. Negative Coliform Controls

A start and finish MF control test (rinse water, medium, and supplies) run with each filtration series . . . . . ____
When controls indicate contamination occurred, all data on affected samples rejected and resampling requested . . . . . ____

c. Total Coliform Confirmed Test

Presumptive tubes with heavy growth but no gas production submitted to confirmed test to check for suppression of coliforms. Confirmation procedure carried out every 3 months on one sample from each problem water supply . . . ____

d. Duplicate analyses (optional)

Duplicate analyses run on positive polluted samples not to exceed 10 percent but a minimum of one per month (optional) . . . . . ____

e. Positive Control Samples (optional)

One positive control sample (polluted water) run each month (optional)

f. Colony Counting (If More Than One Analyst in Laboratory) (optional)

Two or more analysts count sheen colonies; all colonies are verified; analysts' counts compared to verified counts; procedure is carried out at least once per month (optional)

g. Check Analyses by State Laboratories (optional)

A minimum of samples, proportional to the local laboratory work load, processed by State laboratory (see criteria for recommendations) (optional)

2. Quality Control of Equipment, Supplies and Media

a. Records

Satisfactory records containing complete quality control checks on equipment, supplies, and media available for inspection . . . . . ____

b. Equipment and Supplies

Service contracts or approved internal protocol maintained on balance, autoclave, water still, etc.; service records entered in a log book . . . . . ____
Glass thermometers calibrated annually against a certified thermometer; metal thermometers checked quarterly . . . . . ____
pH Meters standardized with pH 7.0 buffer. . . . . ____
Laboratory pure water analyzed as described in criteria . . . . . ____
Lot numbers and dates of receipt of membrane filters recorded (optional)
Heat-sensitive tapes and/or spare strips/ampoules used during sterilization (optional)

c. Media Quality Control

Laboratory chemicals of Analytical Reagent Grade . . . . . ____
Dyes certified for bacteriological use. . . . . ____
pH checked and recorded on each batch of medium after preparation and sterilization . . . . . ____
Causes for deviations beyond ± 0.2 pH units specified . . . . . ____
Media ordered on a basis of 12-month need; purchased in 1/4-lb. quantities, except those used in large amounts (optional)
Bottles dated on receipt and when opened (optional)
Opened bottles of routinely used media discarded within 6 months (if stored in desiccator storage may be extended) (optional)
Shelf life of unopened bottles not in excess of 2 years (optional)
New lots of media quality tested against satisfactory lot using natural water samples (optional)

Laboratory _____ Evaluator _____

Location _____ Date _____

DATA REPORTING

Sample information and laboratory data fully recorded ..... ____
Direct MF counts and/or confirmed MPN results reported promptly ..... ____
After MF verification and/or MPN completion, adjusted counts reported..... ____
One copy of report form retained in laboratory or by State program for 3 years ..... ____
Test results assembled and available for inspection (optional)

Laboratory _____ Evaluator _____

Location _____ Date _____

ACTION RESPONSE TO LABORATORY RESULTS

Unsatisfactory test results given action response and resampled as defined in National Interim Primary Drinking Water Regulations ..... ____

State and responsible local authority notified within 48 hours after check samples confirm coliform occurrence ..... ____

All data reported to State and local authorities within 40 days ..... ____

Chapter VI

RADIOCHEMISTRY: CRITERIA AND PROCEDURES FOR INTERIM CERTIFICATION OF LABORATORIES INVOLVED IN ANALYSIS OF PUBLIC WATER SUPPLIES

The criteria and procedures contained herein in **bold** are the minimum requirements considered essential for laboratories seeking certification for the radioanalysis of public water supplies. These include certain laboratory facilities and instrumentation, sample handling and preservation, methodology, and quality control. The other items, involving personnel, general laboratory facilities, equipment and instrumentation, practices, data reporting, and action response are optional.

Until National Revised Primary Drinking Regulations require mandatory certification of water supply laboratories, all specifications, except those associated with the radioanalytical methods cited in the *Federal Register* (Vol. 41, No. 133, July 9, 1976), and the instrumentation needed to make the required measurements will be considered as guidelines to be used by certification officials. At that time, minimum requirements will be essential to certification of laboratories involved in analysis of public water supplies.

All laboratories, including those that exceed the guidelines and requirements outlined herein, are urged to maintain and continually improve their personnel, facilities, equipment, instrumentation, and quality control procedures. To ensure continued production of scientifically and legally defensible data, an ongoing training program should be an integral part of a laboratory's program.

Minimum requirements are shown throughout in **bold**.

PERSONNEL[1] (OPTIONAL REQUIREMENTS)

Technician or Analyst Responsible for Measurement of Gross Alpha and Gross Beta Activities in Those Laboratories Being Certified Only for These Measurements

The following requirements are optional for a technician or analyst for measurement of gross alpha and gross beta activities:

- *Academic training:* Minimum of a high school diploma or its equivalent, plus at least 2 weeks of specialized training in standards and sample preparation, instrument calibration, calculations, and data handling.
- *Experience:* Minimum of 6 months of on-the-job training and experience in routine radiochemistry.

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[1] Exceptions will be made for those persons employed by the laboratory and currently doing the required analyses prior to promulgation of the interim regulations provided that within 2 years after June 24, 1977, they receive a minimum of 2 weeks of additional training in standards preparation, radioanalytical procedures, and quality control techniques.

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Supervisory or Senior Analyst for Radioanalytical Procedures Employed in Those Laboratories Involved in Specific Analyses of One or More of the Radionuclides Described in the National Interim Primary Drinking Water Regulations

The following requirements are optional for a supervisor or senior analyst for radioanalytical procedures:

- *Academic training:* Minimum of bachelor's degree in chemistry, radiochemistry, radioisotope technology, or its equivalent.
- *Experience:*[1] Minimum of 1 year of appropriate experience in low-level radiation measurements and radiochemical procedures being considered for certification.

This analyst may be assisted in routine sample preparation and radioanalytical procedures by one or more technicians with at least the minimum qualifications described in item 1, provided that such work is directly supervised by the senior analyst.

Laboratory Supervisor, Manager, or Director

The following requirements are optional for a laboratory supervisor, manager, or director:

- *Academic training:* Minimum of bachelor's degree or its equivalent.
- *Experience:*[1] Minimum of 5 years of experience.

LABORATORY FACILITIES

Minimum Requirements

The counting instrument(s) required for measurement of those radionuclides described in the *Federal Register* (Vol. 41, No. 133, July 9, 1976) must be located in a room other than the one in which samples and standards are being prepared or in which other types of chemical analyses are being performed. Temperature of this room must not exceed 27°C. Temperature variation under normal operating conditions must not exceed 3°C.

All instruments must be properly grounded, and a regulated power supply, either external or internal, shall be available to each instrument.

In areas where radioactive standards are being prepared, care must be taken to minimize contamination of surfaces and personnel. Either bench surfaces of an impervious material covered with absorbent paper, or trays (stainless steel, plastic, or fiberglass) lined with absorbent paper are acceptable.

Optional Requirements

Laboratory space should be adequate (100 to 150 ft^2 per analyst is recommended). This space must contain no less than 15 linear ft of bench space and include the following:

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[1] Each year of college-level training in related scientific fields or demonstrated equivalency shall be considered equal to 1 year of work experience. Such a substitution should not exceed one-half of the required experience.

- Sink with hot and cold running water.
- Electrical outlets (120 V a.c. grounded).
- Source of distilled or deionized water.
- Gas supply (natural gas or liquefied petroleum). A propane cylinder with proper attachments may be adequate in laboratories doing limited amounts of analytical work.
- Vacuum line, pump, or aspirator.
- Exhaust hood.

LABORATORY EQUIPMENT AND INSTRUMENT SPECIFICATIONS (OPTIONAL REQUIREMENTS)

The instruments listed below are those commonly found in most radioanalytical laboratories. However, only those instruments needed to prepare and analyze the specific standards and samples for which the laboratory is being certified are required. Such instruments, when required, should meet the following specifications:

General Instrumentation and Equipment

The following are specifications for general instrumentation and equipment:

- *Analytical balance:* Precision, ±0.05 mg. Minimum scale readability, 0.1 mg.
- *pH meter or specific ion meter:*
  - *–pH meter:* Accuracy, ±0.5 units. Scale readability, ±0.1 units. Instrument may be either line/bench or battery/portable.
  - *–Specific ion meter:* Expanded scale millivolt capability. Readable and accurate to ±0.1 mV. Instrument may be either line/bench or battery/portable.
- *Conductivity meter:* Readable in ohms or mhos, a range of 2 to 2.5 million ohms or micromhos ±1 percent, and a sensitivity of 0.33 percent or better. Meter may be either line/bench or battery/portable.
- *Drying oven:* Gravity convection type.
- *Desiccator:* Glass or plastic models, depending on particular application.
- *Hot plate:* Large or small units with selectable temperature control for safe heating of laboratory reagents and samples.
- *Glassware:* Borosilicate type glass. All volumetric glassware should be marked Class A, denoting that it meets Federal specifications and need not be calibrated before use.
- *Muffle furnace:* Automatically controlled with a chamber capacity of at least 2,200 cc (10 X 9.5 X 23) and a maximum operating temperature of 1,000°C continuous and 1,100°C intermittent.
- *Centrifuge:* General purpose table-top model with a maximum speed of at least 3,000 rpm and a loading option of 4 X 50 ml.
- *Fluorometer:* Capable of detecting 0.0005 μg of uranium.

Radiation Instruments

The types of radiation counting systems needed to comply with measurements described in the *Federal Register*, Vol. 41, No. 133, July 9, 1976, are set forth below. Only those instruments needed to analyze for those activities or specific radionuclides for which the laboratory is being certified are required. Such instruments should meet the following specifications:

- *Liquid scintillation system:* A liquid scintillation system is required if the laboratory is to be certified for measurement of tritium in drinking water samples. The system shall be such that the sensitivity will meet or exceed the requirements of section 141.25 of the Interim Primary Regulations (*Federal Register*, Vol. 41, No. 133, July 9, 1976).
- *Gas-flow proportional counting system:* A gas-flow proportional counting system may be used for the measurement of gross alpha and gross beta activities, radium-226, radium-228, strontium-89, strontium-90, cesium-134, and iodine-131 as described in the reference cited in section 141.25(a). The detector may be either a "windowless" (internal proportional counter) or a "thin window" type. A minimum shielding equivalent to 5 cm of lead must surround the detector. A cosmic (guard) detector should be operated in anticoincidence with the main detector. The system shall be such that the sensitivity of the radioanalysis of water samples will meet or exceed the requirements of section 141.25.

  For measurement of gross alpha activities and radium-226, a scintillation system designed for alpha counting may be substituted for the gas-flow proportional counter described. In such a system, a Mylar disc coated with a phosphor (silver-activated zinc sulfide) is either placed directly on the sample or on the face of a photomultiplier tube, enclosed within a light-tight container, along with the appropriate electronics (high voltage supply, amplifier, timer, and scaler).
- *Scintillation cell system:* For the specific measurement of radium-226 by the radon emanation method, a scintillation system designed to accept scintillation flasks ("Lucas cells") shall be used. The system consists of a light-tight enclosure capable of accepting the scintillation flasks, a detector (phototube), and the appropriate electronics (high voltage supply, amplifier, timers, and scalers). The flasks (cells) required for this measurement may either be purchased from commercial suppliers or constructed according to published specifications (Lucas, H. F., "Improved Low-Level Alpha Scintillation Counter for Radon," *Rev. Sci. Instrum.*, 28:680, 1967).
- *Gamma spectrometer systems:* Either a sodium iodide (NaI(T1)) crystal or a solid state lithium drifted germanium (Ge(Li)) detector connected to a multichannel analyzer is required if the laboratory is to be certified for analyses of manmade photon emitters.

  If a sodium iodide detector is used, a 7.5 cm × 7.5 cm NaI cylindrical crystal is satisfactory. However, a 10 cm × 10 cm crystal is recommended. The detector must be shielded with a minimum of 10 cm of iron or equivalent. It is recommended that the distance from the center of the detector to any part of the shield should not be less than 30 cm. The multichannel analyzer, in addition to appropriate electronics, must contain a memory of not less than 200 channels and at least one readout device.

  A system with a lithium drifted germanium (Ge(Li)) detector may be used for measurement of manmade photon emitters if the efficiency of the detector is such that the sensitivity of the system meets the minimum detectable activity requirements cited in section

141.25. The Ge(Li) detector must be shielded with a minimum of 10 cm of iron or equivalent. The multichannel analyzer, in addition to appropriate electronics, must contain a memory of not less than 2000 channels and at least one readout device.

GENERAL LABORATORY PRACTICES (OPTIONAL REQUIREMENTS)

The following requirements are optional for general laboratory practices:

- *Glassware preparation:* All glassware should be washed in a warm detergent solution and thoroughly rinsed in tap water. A distilled water rinse should follow the tap water rinse. This cleaning procedure is sufficient for most analytical needs. However, specific analytical methods may dictate the need for more elaborate procedures for ensuring cleanliness of glassware.
- *Water quality:* All water used in preparation of reagents, standards, and samples should have resistance values between 0.5 and 2.0 megohms (2.0 to 0.5 micromhos)/cm at 25°C. Excellent quality water has resistance values exceeding 1.0 megohms/cm (less than 1.0 micromhos/cm). If such high quality water is not available in the laboratory, it may be purchased from commercial suppliers; the laboratory should request a list of quality specifications for water purchased and periodically check actual quality against these specifications.
- *Chemicals and reagents:* "Analytical reagent grade" (AR) chemicals should be used for most analyses. Consult the 14th edition of "Standard Methods for the Examination of Water and Wastewater" (published in 1975 by the American Public Health Association) section 102, page 5-8 (or the latest edition published) for more detailed information on reagent grades. Individual analytical procedures in "Standard Methods" often specify special requirements for reagents to be used.
- *Storage of radioactive standards and radioactive wastes:* There should be an enclosed and properly labeled area, either within the analytical laboratory or in a separate room, for the safe storage (in suitable containers) of standards, samples, and radioactive wastes.
- *Standards and sample preparation:* There should be a designated area within the laboratory for preparation of radioactive standards and samples. Adequate precautions should be taken in this area to ensure against radioactive contamination. Provisions should be made for safe storage and disposal of radioactive wastes and for monitoring of the work area.

RADIOCHEMISTRY (MINIMUM REQUIREMENTS)

Table VI-1 gives the minimum requirements for sample handling including preservation, methodology, and major instrumentation.

QUALITY CONTROL

Minimum Requirements

Quality control data and records must be available for inspection.
Laboratory must participate at least twice each year in those EPA laboratory intercomparison

Table VI-1.—*Sample handling, preservation, methodology*[1] *and major instrumentation (minimum requirements)*

Parameter	Preservative[2]	Container[3]	Instrumentation[4]
Gross alpha	Concl. HCl or HNO_3 to pH<2[5]	P or G	A or B
Gross beta	Concl. HCl or HNO_3 to pH<2[5]	P or G	A
Strontium-89	Concl. HCl or HNO_3 to pH<2	P or G	A
Strontium-90	Concl. HCl or HNO_3 to pH<2	P or G	A
Radium-226	Concl. HCl or HNO_3 to pH<2	P or G	A, B, or D
Radium-228	Concl. HCl or HNO_3 to pH<2	P or G	A
Cesium-134	Concl. HCl to pH<2	P or G	A or C
Iodine-131	None	P or G	A
Tritium	None	G	E
Uranium	Concl. HCl or HNO_3 to pH<2	P or G	F
Photon emitters	Concl. HCl or HNO_3 to pH<2	P or G	C

[1] *Federal Register*, Vol. 41, No. 133, July 9, 1976.

[2] It is recommended that the preservative be added to the sample at the time of collection unless suspended solids activity is to be measured. However, if the sample must be shipped to a laboratory or storage area, acidification of the sample (in its original container) may be delayed for a period not to exceed 5 days. A minimum of 16 hours must elapse between acidification and analysis.

[3] P = Plastic, hard or soft; G = Glass, hard or soft.

[4] A = Low background proportional system; B = Alpha scintillation system; C = Gamma spectrometer (NaI(Tl) or GE(Li)); D = Scintillation cell (radon) system; E = Liquid scintillation system (section C.2.a); F = Fluorometer (section C.1.i).

[5] If HCl is used to acidify samples which are to be analyzed for gross alpha or gross beta activities, the acid salts must be converted to nitrate salts before transfer of the samples to planchets.

studies that include each of the analyses for which the laboratory is, or wants to be, certified. Analytical results must be within control limits described in "Environmental Radioactivity Laboratory Intercomparison Studies Program–FY-1977" (EPA-600/4-77-001), or in subsequent revisions.

Laboratory must participate once each year in an appropriate unknown performance study administered by EPA. Analytical results must be within control limits established by EPA for each analysis for which the laboratory is, or wants to be, certified.

Operating manuals and calibration protocols for counting instruments must be available to analyst(s) and technician(s).

Calibration data and maintenance records on all radiation instruments and analytical balances must be maintained in a permanent record.

The following specifications are included in minimum daily quality control:

- To verify internal laboratory precision for a specific analysis, a minimum of 10-percent duplicate analyses must be performed. The difference between duplicate measurements must be less than two times the standard deviation of the specific analysis as described in EPA-600/4-77-001. If difference exceeds two standard deviations, prior measurements are suspect, calculations and procedures must be examined, and samples should be reanalyzed when necessary.

- **When 20 or more specific analyses are performed each day, a performance standard and a background sample must be measured with each 20 samples. If less than 20 specific analyses are performed in any 1 day, a performance standard and a background sample must be measured along with the samples.**
- **Quality control performance charts, or performance records, must be maintained.**

Optional Requirements

Optional requirements include the following:

- Current service contract should be in effect on all balances.
- Class S weights should be available to make periodic checks on balances.
- Chemicals should be dated upon receipt of shipment and replaced when needed or before shelf life has been exceeded.
- Electronics technician or service contract should be in effect for instruments.

DATA REPORTING (OPTIONAL REQUIREMENTS)

Records of radioanalyses should be kept by the laboratory for not less than 3 years. This includes all raw data, calculations, quality control data, and reports.

Actual laboratory reports may be kept. However, all data, with the exception of compliance check samples as detailed in section 141.33(b) of the National Interim Primary Drinking Water Regulations, may be transferred to tabular summaries provided that the following information is included:

- Date, place, and time of sampling; name of person who collected the sample.
- Identification of sample as to whether it is a routine distribution system sample, check sample, raw or process water sample, surface or ground water sample, or other special purpose sample.
- Date of receipt of sample and analysis.
- Laboratory and persons responsible for performing analysis.
- Analytical technique/method used.
- Results of analysis.

ACTION RESPONSE TO LABORATORY RESULTS (MINIMUM REQUIREMENTS)

When action response is a designated laboratory responsibility, the water plant operator and State engineer are promptly notified of unsatisfactory sample results, and a request is made for resampling from the same sampling point.

SAMPLE FORMS FOR ON-SITE EVALUATION OF LABORATORIES INVOLVED IN ANALYSIS OF PUBLIC WATER SUPPLIES–RADIOANALYSIS

LABORATORY: _____

STREET: _____

CITY: _____ STATE: _____

SURVEY BY: _____

AFFILIATION: _____

DATE: _____

NOTE: Material on pages 76-89, except where indicated, are minimum requirements.

PERSONNEL

SAMPLE FORM ONLY

Laboratory _____

Location _____

Date _____

Evaluator _____

Position/title	Name	Academic training				Present specialty	Experience (years/area)
		HS	BA/BS	MA/MS	Ph.D.		
Analyst(s)/technician(s)							
Supervisory analyst							
Laboratory supervisor/ director							
Support (e.g., electronic technician)							

LABORATORY FACILITIES

SAMPLE FORM ONLY

Laboratory _____

Location _____

Date _____

Evaluator _____

Item	Available		Comments
	Yes	No	
Labspace (cite ft^2/person)			
Bench space (linear feet)			
Sink (with hot and cold running water)			
Electrical services			
Distilled water			
Exhaust hood			
Other			

LABORATORY EQUIPMENT AND INSTRUMENT SPECIFICATIONS–GENERAL

SAMPLE FORM ONLY

Laboratory_____

Location_____

Date_____

Evaluator_____

Item	Number of units	Make	Model	Age
Analytical balance				
pH meter				
Specific ion meter				
Conductivity meter				
Drying oven				
Desiccator				
Hot plate				
Glassware				
Muffle furnace				
Centrifuge				
Fluorometer				

COUNTING ROOM FACILITIES

Laboratory _____

Location _____

SAMPLE FORM ONLY

Date _____

Evaluator _____

Item	Available		Comments	Satisfactory	
	Yes	No		Yes	No
Counting area space (total ft^2)					
Counting area isolated from sample preparation area					
Regulated electrical services					
Adequate ground available					

RADON GAS-COUNTING SYSTEM

Laboratory _____

Location _____

Date _____

Evaluator _____

SAMPLE FORM ONLY

System number	Counting instrument			Gas-counting cells/system	Manufacturer of gas-counting cells
	Make	Model	Year		

	Calibration frequency[1]				Service maintenance frequency[2]				Condition[3]		
	D	W	M	Other	Q	S	A	Other	G	P	No

[1] Daily, weekly, monthly.
[2] Quarterly, semiannually, annually.
[3] Good, operating but needs repair, not operating.

Are operating manuals readily available to the operator? Yes __ No __
Are calibration protocols available to the operator? Yes __ No __
Are calibrations kept in a permanent control chart record? Yes __ No __
Are permanent service maintenance records kept on these systems? Yes __ No __
Satisfactory Yes __ No __

LIQUID SCINTILLATION COUNTER

SAMPLE FORM ONLY

Laboratory _____

Location _____

Date _____

Evaluator _____

Instrument number	Manufacturer	Model	Year	Sample changing		
				Manual	Automatic	Capacity

Discriminator channels			Data readout				External standard		Refrigeration	
			Visual	Channel printout						
1	2	3		1	2	3	Yes	No	Yes	No

Calibration frequency[1]				Service maintenance frequency[2]				Condition[3]		
D	W	M	Other	Q	S	A	Other	G	P	No

[1] Daily, weekly, monthly.
[2] Quarterly, semiannually, annually.
[3] Good, operating but needs repair, not operating.

Are manufacturer's operating manuals readily available to the operator? Yes ___ No ___
Is there a calibration protocol available to the operator? Yes ___ No ___
Are calibrations kept in a permanent control chart record? Yes ___ No ___
Is a permanent service maintenance record kept on these instruments? Yes ___ No ___
Satisfactory Yes ___ No ___

WINDOWLESS GAS-FLOW PROPORTIONAL COUNTER

SAMPLE FORM ONLY

Laboratory _____

Location _____

Date _____

Evaluator _____

Instrument number	Manufacturer	Model	Year	Sample changing		
				Manual	Automatic	Capacity

Counting gas	Sample dish diameter (in)	Instrument background			
		Alpha		Beta	
		Operating voltage	cpm	Operating voltage	cpm

Calibration frequency[1]				Service maintenance frequency[2]				Condition[3]		
D	W	M	Other	Q	S	A	Other	G	P	No

[1] Daily, weekly, monthly.
[2] Quarterly, semiannually, annually.
[3] Good, operating but needs repair, not operating.

Are operating manuals readily available to the operator? Yes ___ No ___
Is there a calibration protocol available to the operator? Yes ___ No ___
Are calibrations kept in a permanent control chart record? Yes ___ No ___
Is a permanent service maintenance record kept on these instruments? Yes ___ No ___
Satisfactory Yes ___ No ___

THIN WINDOW GAS-FLOW PROPORTIONAL COUNTER

SAMPLE FORM ONLY

Laboratory _____

Location _____

Date _____

Evaluator _____

Instrument number	Manufacturer	Model	Year	Sample changing		
				Manual	Automatic	Capacity

Counting gas	Window density (g/cm^2)	Instrument background			
		Alpha		Beta	
		Operating voltage	cpm	Operating voltage	cpm

Calibration frequency[1]				Service maintenance frequency[2]				Condition[3]		
D	W	M	Other	Q	S	A	Other	G	P	No

[1] Daily, weekly, monthly.
[2] Quarterly, semiannually, annually.
[3] Good, operating but needs repair, not operating.

Are manufacturer's operating manuals readily available to the operator? Yes ___ No ___
Is there a calibration protocol available to the operator? Yes ___ No ___
Are calibrations kept in a permanent control chart record? Yes ___ No ___
Is a permanent service maintenance record kept on these instruments? Yes ___ No ___
Satisfactory Yes ___ No ___

ALPHA SCINTILLATION COUNTER

SAMPLE FORM ONLY

Laboratory _____

Location _____

Date _____

Evaluator _____

Instrument number	Manufacturer	Model	Year	Sample changing		
				Manual	Automatic	Capacity

Alpha phosphor location		Instrument background	
Photo tube	Samples	Operating voltage	cpm

Calibration frequency[1]				Service maintenance frequency[2]				Condition[3]		
D	W	M	Other	Q	S	A	Other	G	P	No

[1] Daily, weekly, monthly.
[2] Quarterly, semiannually, annually.
[3] Good, operating but needs repair, not operating.

Are manufacturer's operating manuals readily available to the operator? Yes ___ No ___
Is there a calibration protocol available to the operator? Yes ___ No ___
Are calibrations kept in a permanent control chart record? Yes ___ No ___
Is a permanent service maintenance record kept on these instruments? Yes ___ No ___
Satisfactory Yes ___ No ___

GAMMA SPECTROMETER SYSTEMS

SAMPLE FORM ONLY

Laboratory _____

Location _____

Date _____

Evaluator _____

System number	Detector system				
	Type	Make	Model	Year	Size

Analyzer system			
Make	Model	Year	Channels

Calibration frequency[1]				Service maintenance frequency[2]				Condition[3]		
D	W	M	Other	Q	S	A	Other	G	P	No

[1] Daily, weekly, monthly.
[2] Quarterly, semiannually, annually.
[3] Good, operating but needs repair, not operating.

Are operating manuals readily available to the operator? Yes ___ No ___
Are calibration protocols available to the operator? Yes ___ No ___
Are calibrations kept in a permanent control chart record? Yes ___ No ___
Are permanent service maintenance records kept on these systems? Yes ___ No ___
Satisfactory Yes ___ No ___

GENERAL LABORATORY PRACTICES

SAMPLE FORM ONLY

Laboratory_____

Location_____

Date_____

Evaluator_____

Item	Comments (where applicable, cite system, quality control check, adequacy of procedures)
Glassware preparation	
Water quality (distilled/deionized)	
Chemicals/reagents	
Radioactive standards and wastes	
Standards and sample preparation	
Other	

SAMPLE HANDLING, PRESERVATION, METHODOLOGY, AND MAJOR INSTRUMENTATION

SAMPLE FORM ONLY

Laboratory _____

Location _____

Date _____

Evaluator _____

Parameter	Container used	Preservative used	Comments	Satisfactory	
				Yes	No
Gross alpha activity					
Gross beta activity					
Strontium-89					
Strontium-90					
Radium-226					
Radium-228					
Cesium-134					
Iodine-131					
Tritium					
Uranium					
Photon emitters:					
a.					
b.					
c.					
d.					
e.					

METHODOLOGY

SAMPLE FORM ONLY

Laboratory _____

Location _____

Date _____

Evaluator _____

Parameter	Name or description of method	Method used (Cite page and year)				Frequency			Satisfactory	
		FR	ASTM	EPA	Other	Daily	Weekly	Monthly	Yes	No
Gross alpha activity										
Gross beta activity										
Strontium-89										
Strontium-90										
Radium-226										
Radium-228										
Cesium-134										
Iodine-131										
Tritium										
Uranium										
Photon emitters (identify): a.										
b.										
c.										
d.										
e.										

QUALITY CONTROL

SAMPLE FORM ONLY

Laboratory _____

Location _____

Date _____

Evaluator _____

Item	Done			Comments	Satisfactory	
	Yes	No	Frequency		Yes	No
Minimum requirements:						
Participation in intercomparison studies						
Use of unknown performance sample						
Verification of samples						
Use of quality control charts or records						
Operation manuals and calibration protocols available to analyst						
Quality control data (including calibration and maintenance records) available						
Optional requirements:						
Service contract on balances						
Use of Class S weights						
Dating and replacement of chemicals						
Electronics technician available or service contracts on instruments						

DATA REPORTING

SAMPLE FORM ONLY

Laboratory_____

Location_____

Date _____

Evaluator_____

Item	Comments: system(s) used, frequency, etc.
Records kept for 3 years: Actual laboratory reports	
Tabular summary	
Information included: Date	
Place of sampling	
Time of sampling	
Person collecting sample	
Date of receipt of sample	
Date of analysis	
Type of analysis	
Laboratory and person responsible	
Method(s) used	
Results	

GLOSSARY

Analyst: A chemist, microbiologist, physicist, or technician who actually performs a test. The analyst may carry out the complete test or participate jointly with other analysts. The qualifications an analyst needs depend greatly on functions being performed.

Interim Approval: An administrative recognition to temporarily certify laboratories until EPA establishes its program of Interim Certification. Laboratories awarded Interim Approval must be evaluated on-site by EPA as soon as possible after the Region has been certified. (See Water Supply Guidance to the Regional Water Supply Representatives, No. 39.)

Interim Certification: Nonregulatory recognition given to any laboratory that it meets minimal analytical performance standards.

Interim Certification (Provisional): Qualified recognition given to any laboratory, granting a grace period of up to 1 year to correct deficiencies.

Local Laboratory: Any laboratory under a state or EPA certification program which performs analyses for drinking water under the Safe Drinking Water Act. A local laboratory may be a laboratory of the Federal, State, or local government or a private laboratory located in or out of a particular State or Region.

Minimum Requirements: Criteria which are critical to the generation of valid data. These criteria describe the lowest level of capability at which the analyses can be successfully performed.

Optional Requirements: Suggested criteria which would contribute to the goal of accurate and precise data. Optional Requirements recognize that there are equivalent and alternate criteria equally as good or better.

Primary Enforcement Responsibility: The primary responsibility for administration and enforcement of primary drinking water regulations and related requirements applicable to public water systems within a State.

Principal Laboratory: A laboratory that has major analytical capability and/or enforcement responsibility for water supplies with respect to analytical data under the Safe Drinking Water Act. Any Federal, State, or local government or private laboratory located in or out of a particular State or Region may be designated a Principal Laboratory by the agency with primary enforcement responsibility.

Quality Control Samples: Known value samples distributed on a continuing basis by the EMLS's of EPA for use as secondary check on their within-laboratory quality control programs.

State: The agency of the State government which has jurisdiction over public water systems. During any period when a State does not have primary enforcement responsibility under section 1413 of the Safe Drinking Water Act, the term "State" means the Regional Administration, U.S. Environmental Protection Agency.

Supervisor: The chemist, microbiologist, or physicist who is directly responsible for the technical performance of analysts for a given test(s) or test area or section. The supervisor may or may not actually perform the test operations but should be cognizant of and preferably experienced in the test operations being performed under his direction.